

MSI9000

Spread Spectrum RF

Operator's Manual



**Measurement Systems
International™**

A RICE LAKE WEIGHING SYSTEMS COMPANY

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SECTION 1 – INTRODUCTION & INSTALLATION

INTRODUCTION

CellScale™ establishes Measurement Systems International (MSI) as the first company to produce a weighing system that fully integrates omnidirectional, wireless communication. The innovative new concept, called “cellular weighing,” offers several ways to dramatically improve your process of weighing and information acquisition. CellScale™, the system’s central weighing and communication controller, gives you an unprecedented foundation for building your weighing system. For the first time, your system may expand to virtually any combination of load sensors, weight displays and other data recorders — without requiring cables.

Free of the hindrances of cables, your system will be more versatile. Your load sensors and displays may move freely during operation, and your stationary components can be located anywhere you choose. CellScale™ also eliminates the significant cost of cable and conduit installation.

CellScale™ controls all the functions that turn a “dumb” load sensor into an advanced weighing system: zero, tare, check weighing, totalizing, set points, statistics and many others. The functions can be applied simultaneously to numerous load sensors.

CellScale™ consolidates the functionality of dozens of weighing components into one unit. It will save you money by eliminating redundant displays, radio systems and other components.

The Model 9000 CellScale is Legal for Trade (COC# 05-077) when used in conjunction with approved Load Cells and Scale bases. The NTEP Certificate covers the Model 9000 CellScale, 9750A Indicator, the 3750CS indicator, and the 9020 CellModem. LFT status of the 6260CS and other MSI Crane scales is pending.

INSTALLATION

The CellScale™ features a heavy duty, milled enclosure rated at NEMA 4 IP 65 or NEMA 6 IP 67 with the long range antenna option. Whether you utilize crane scales, lift truck scales, hoppers or any other scale, CellScale™ installs easily. It bolts vertically or horizontally either to your load sensors or near your load sensors. The CellScale™ is usable immediately because it does not require an FCC license.

If there are no peripheral devices such as a printer or scoreboard, setup consists of installing the unit in its permanent location (see installation templates), plugging in the Antenna and load sensors, and applying power.

Power—MSI9000

The CellScale is powered by any DC source from 9V to 30V or optionally with 85-265VAC. The universal AC option can also be used with high voltage DC (120VDC to 300VDC)

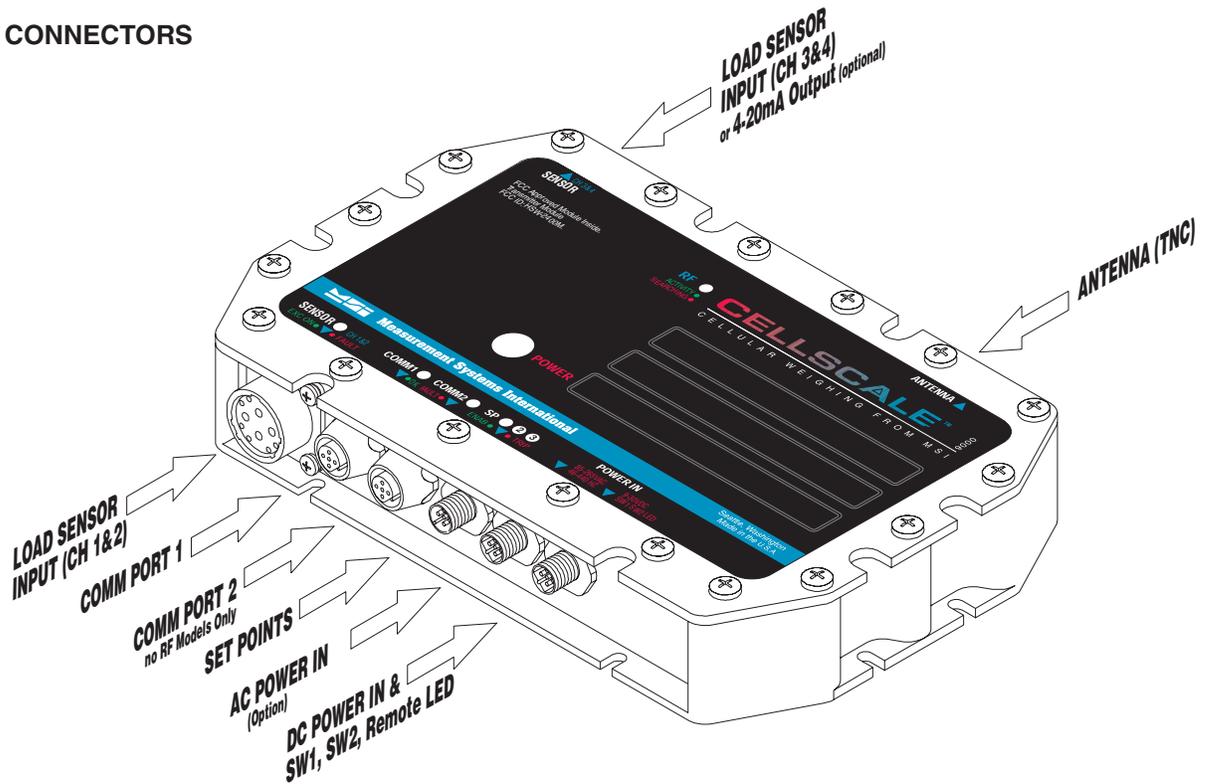
FIRMWARE VERSION NOTICE

This User Guide is intended for CellScale equipment that uses MSI’s next generation of RF Modems. This guide applies only to Models 9000 and CellScale embedded Crane Scales manufactured after 5/1/06. There are menu differences and feature additions not found in first generation CellScales. These devices all have code installed starting with version 5-xx. Version 5-xx is not compatible with older CellScale manufactured before 4/1/06 and the Modems installed cannot communicate with CellScale equipment not specified as having 2nd generation modems.

Older CellScale equipment can be upgraded to 2nd Generation by exchanging the Modems and updating the software. Contact MSI for pricing information.

Previous Versions of this User Guide are available by special request.

CELLSCALE CONNECTORS



Power and Remote Switches Cable

Power is supplied through a pre assembled cable (MSI P/N 12020). It provides for DC power in (9-30Vdc), two switches, and a remote LED indicator. The switches and LED are supplied by the end user.

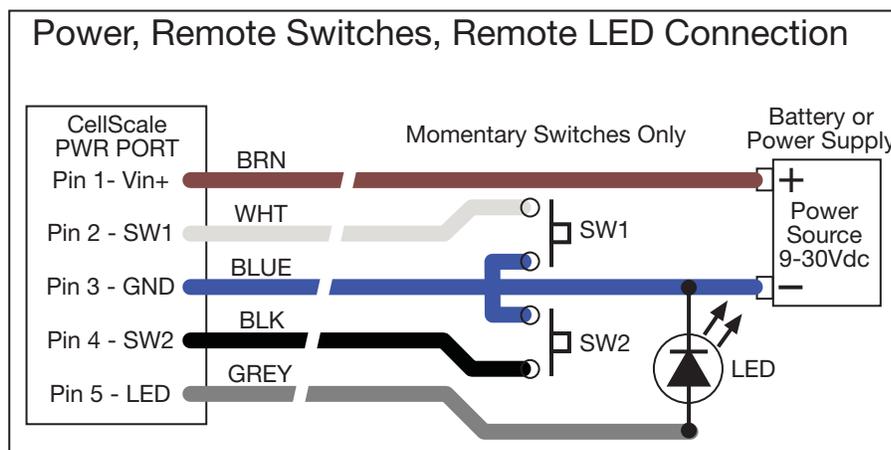
Blue – Connect to Battery Negative or supply ground. It is generally best to connect this directly to the battery negative terminal, or where the negative terminal is attached to the chassis.

Brown – Connect to Battery Positive (9-30VDC). Again, a direct battery connection is usually best to avoid interference with vehicle electrical systems. The CellScale is internally fused. If connected to a breaker or fuse panel, use 2A at 12V, 1A at 24V. Fast blow or medium blow fuses are acceptable.

Black – Switch 1 input. Connect to a Normally Open push-button switch. The other switch terminal must connect to the Blue wire (ground). If this feature is not used, insulate the end of the wire to prevent it from shorting.

White – Switch 2 input. Connect to a Normally Open push-button switch. The other switch terminal must connect to the Blue wire (ground). If this feature is not used, insulate the end of the wire to prevent it from shorting.

Gray – Remote power indication. Connect to the anode of a remote LED. The LED cathode must connect to the Blue wire (ground). No current limit resistor is required, current drive is provided by the CellScale (~20mA). If this feature is not used, insulate the end of the wire to prevent it from shorting. Suitable for LEDs with VF 1.6V to 2.4V@ 20mA. Not suitable for Blue or White LEDs due to their VF >3V.



Sensor Input

The sensor input connector has twelve pins. A minimum scale connection consists of +Excitation, -Excitation, +Signal Ch1, and -Signal Ch1 (4 wire). The user can add +Sense and -Sense for a 6 wire connection to a summing box or 6 wire connected load cell. Plus and minus sense can be left unconnected when not needed. To add a second sensor input, use +Signal Ch2 and -Signal Ch2. Sensors connected to Channel 1 and Channel 2 share excitation. The remaining 4 pins are control signals for the 9008 CellScale Multiplexer. The binary code from these pins corresponds to the sub-channels designated by the scan list.

Figure 1 shows the pinout of the sensor input for the standard 2 Channel CellScale. The view is into the CellScale, which corresponds to the solder cup view of the mating connector (MSI P/N 11968). Contacts A-H are sized for up to 20 AWG wire. Contacts H, J, K, and L are sized for up to 16 AWG wire. Twisted pair wire is recommended with pairs for Signal Ch 1, Sense, Excitation, and Signal Ch 2.

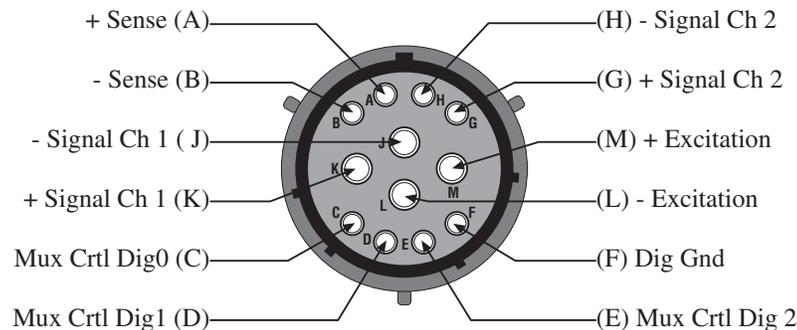


Figure 1 - 2 Channel Sensor Input Connector

The 2nd A/D Option, 4 Channel CellScale adds a second connector opposite to the first. This connector is wired identically to figure 1 except Channel 1 becomes Channel 3 and Channel 2 becomes Channel 4.

The digital lines, if used, should be pair 1 with Dig Gnd and Dig0, pair 2 with Dig1 and Dig2. Do not use digital ground for any load cell connection or shield. Shields should be terminated to the shell.

In addition an overall shield should be used with the shield terminated to the shell of the connector. MSI recommends dual shields with a foil inner shield and a braid shield overall. Outer jackets should be carefully chosen for the intended environment. MSI supplied cables are jacketed with polyurethane, which gives excellent abrasion resistance and is suitable for outdoor use. Do not use common PVC jackets, unless they are certified for the environment the system will be used in. PVC has poor abrasion resistance and poor water resistance. There are newer, specialized types of PVC which are far superior for industrial applications. In short, know your environment, make sure the cable chosen is suitable.

For maximum reliability, use only rosin core solder for wire connections. Clean all flux residue with flux solvent and insulate each solder cup with heat shrink. After wiring and verifying, the connector should be potted, or an environmental backshell should be employed (not supplied by MSI). MSI recommends 3M DP100 as a potting compound. However, using DP100 prevents any future repair of the cable. A silicone based potting compound should be used if this is a concern.

MSI supplies pre wired and potted cables for connections to summing boxes or other junction boxes. These can be ordered in many lengths and watertightness is assured.

Set Point I/O Connector

The Optional Set Point I/O cable (MSI P/N 12018) provides three Set Point outputs coupled to internal solid state opto-isolated relays. These relays are capable of 60V at 350mA. The relays share a common. Since the relays are bidirectional the common line can be connected to ground or any voltage up to 60V peak. This allows DC voltages of 60V peak or AC sine wave voltages of 48VRMS to be switched. However, if the common line is used for the positive input or AC voltage is used, the isolated input is not usable.

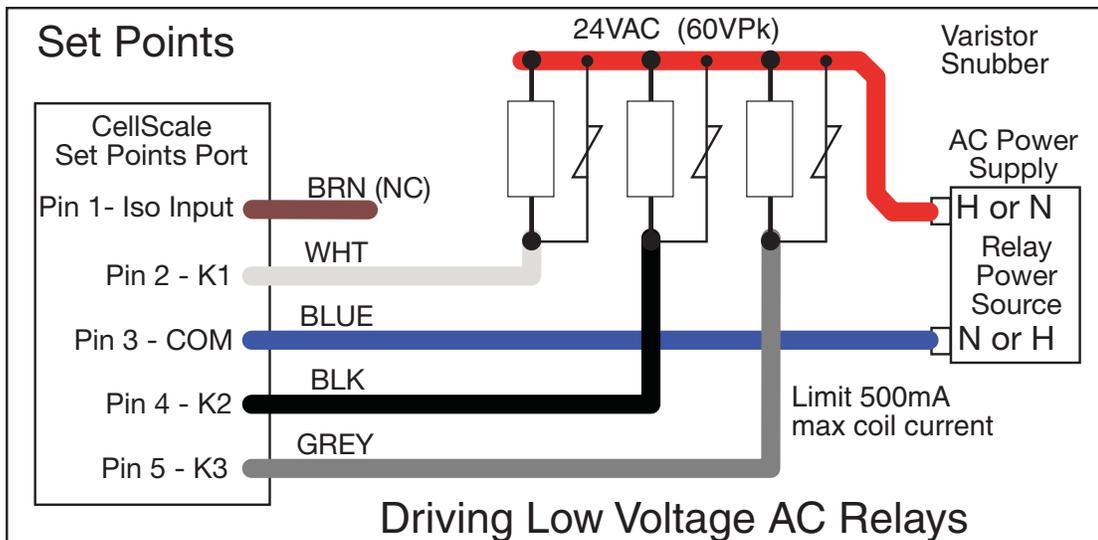
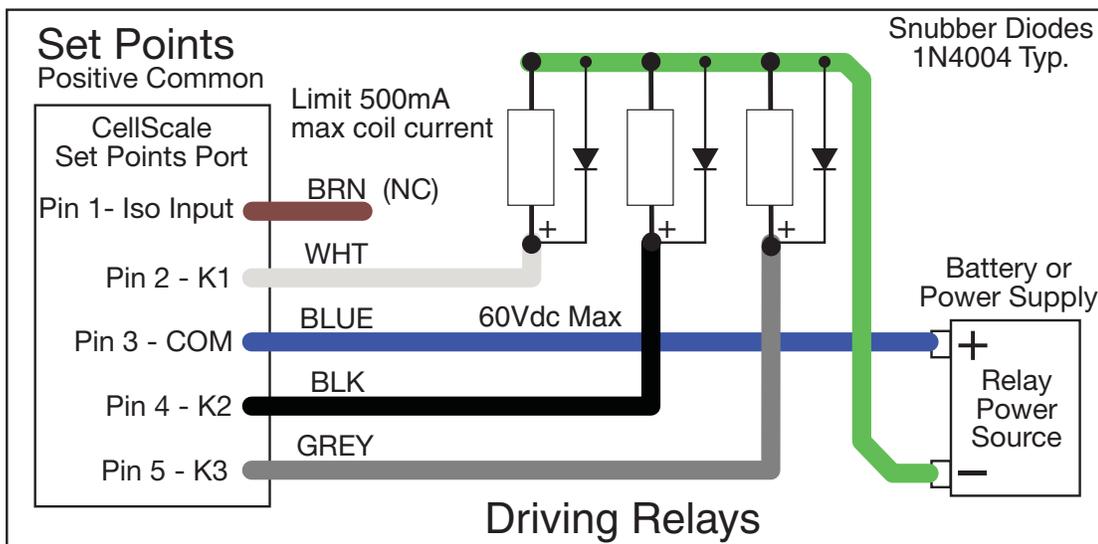
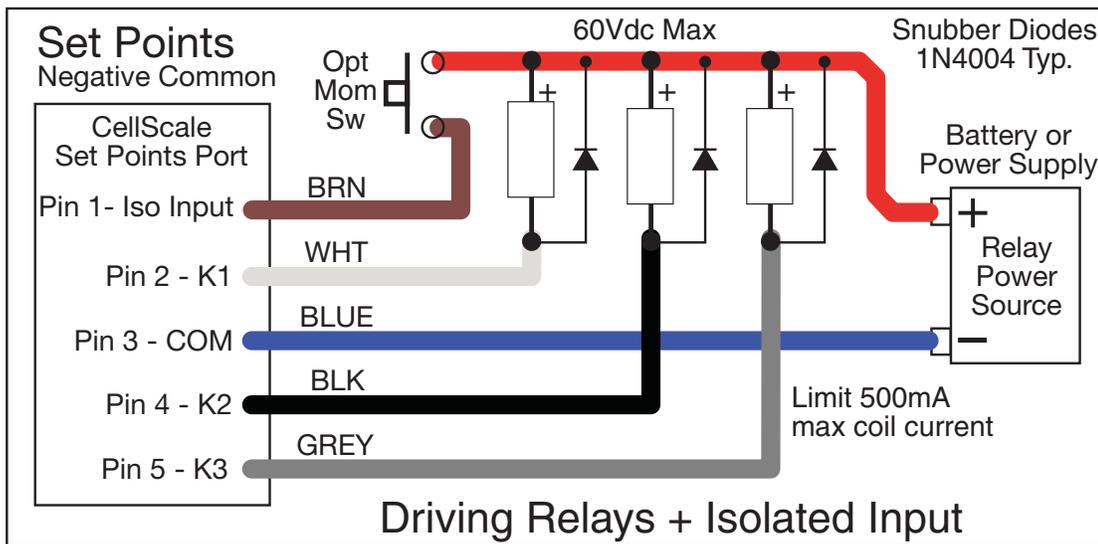
In addition, the I/O cable provides an isolated input that controls the Switch 2 functions (see System Menu for details on programming the function of Switch 2). This input will function with any DC source from 5V to 60V. Apply the positive voltage to ISO Switch Hi and the lower voltage to common. For example, supply 24V

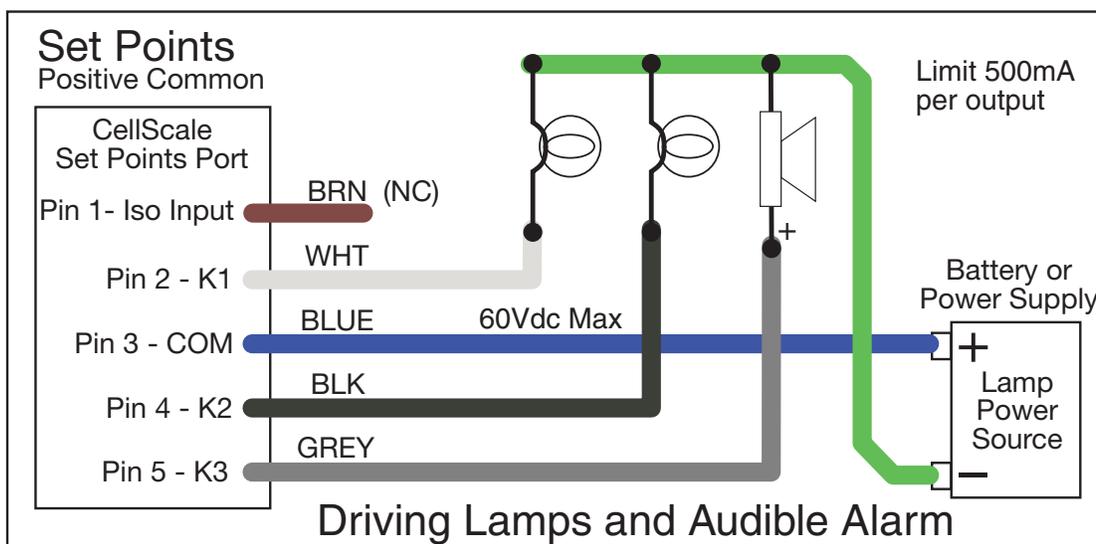
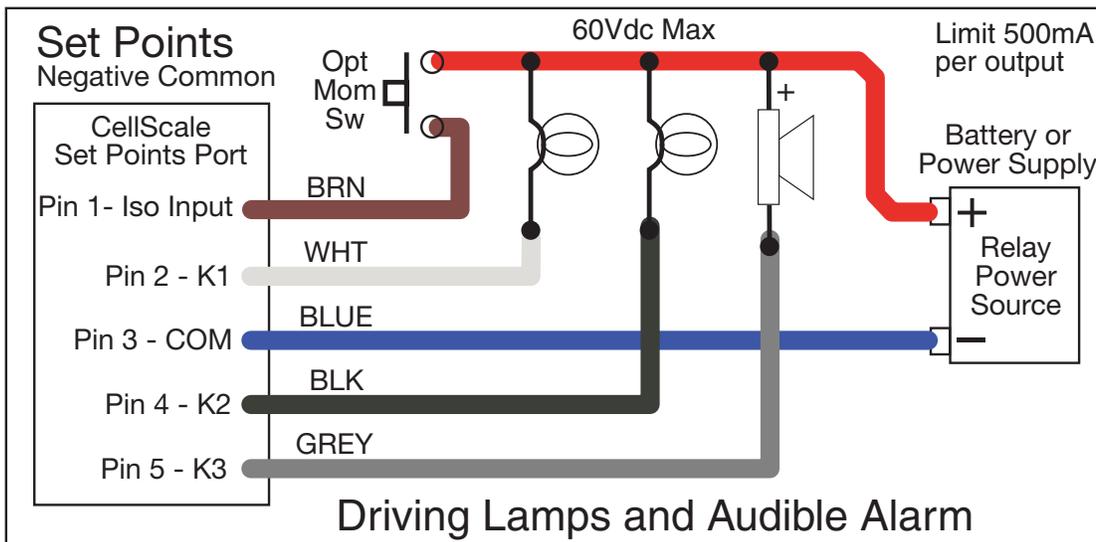


All unused wires must be insulated individually (electrical tape or heatshrink) to prevent shorting out critical control circuitry.

to the Hi wire, and ground to the low wire to trigger the switch 2 function. This must be momentary! The function is edge triggered.

The Common must be low for the isolated input to function. If the Isolated input is not needed, the common can be high or low return.





Set Points Cable Color Code

- Blue – Common for relays and low input for Isolated input
- Brown – Isolated Input High. Connect to input supply from 5 to 60VDC, through a push button or other momentary input (unless the Low input is connected through a momentary contact).
- White – Output Relay 1. Limit to 60V Peak 500mA.
- Black – Output Relay 2. Limit to 60V Peak 500mA.
- Gray – Output Relay 3. Limit to 60V Peak 500mA.

SERIAL PORTS

Comm Port Cables

The CellScale comes standard with one Comm port wired for RS-232 (MSI P/N 501705-0001) following the AT standard for 9 pin serial cables (DCE). An unterminated cable is available (MSI P/N 12023) if you wish to wire your own serial cable for RS-232 or RS-422 or RS-485. Comm Ports 1 and 2 are wired identically. Note that Comm Port 2 is not installed in RF Modem equipped CellScale 9000s.

Comm Port Cable Color Code RS-232

- Brown – Transmit output from CellScale, connect to receive of DTE.
- Black – Receive input to CellScale, connect to transmit of DTE.
- Grey – CTS Input to CellScale. Connect to RTS or RTR output of DTE.

White – RTS/RTR output from CellScale. Connect to CTS input of DTE.

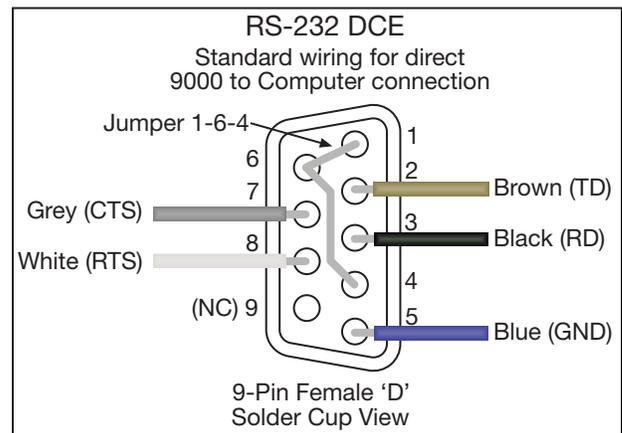
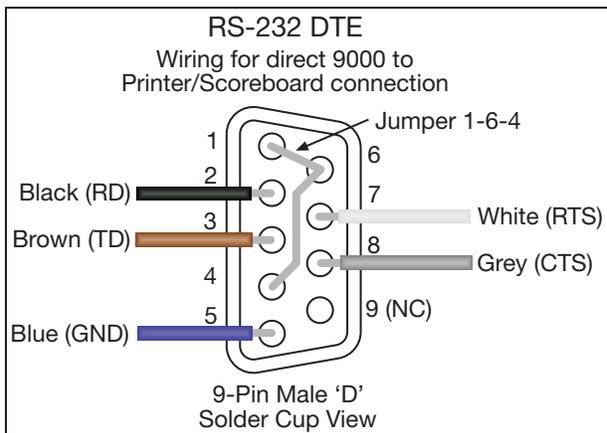
Blue – Signal Ground

Drain Wire – Connect to metal shell.

RS-422/485 Operation

RS-422 and RS-485 serial connections are used when long wire runs are necessary. The 485 spec covers cable runs up to 4000'. 422 and 485 are differential transmissions and require twisted pair wiring to achieve common and normal mode rejection. Although short runs of 422/485 cabling is often just two wires, a ground reference is required. Usually the ground reference is connected through resistors to prevent ground differential current flow. RS422/485 connections require a termination resistor to reduce reflections. See wiring diagrams for details.

Both RS-422 and RS-485 are multi-drop capable. The CellScale can drive up to 32 receivers on one twisted pair. Although the CellScale uses standard RS-485 drivers, the standard software does not have a full duplex protocol. Contact MSI for custom solutions for networking with RS-485.



Comm Port Cable Color Code RS-422/485

Brown – TD+ (Y)

White – TD- (Z)

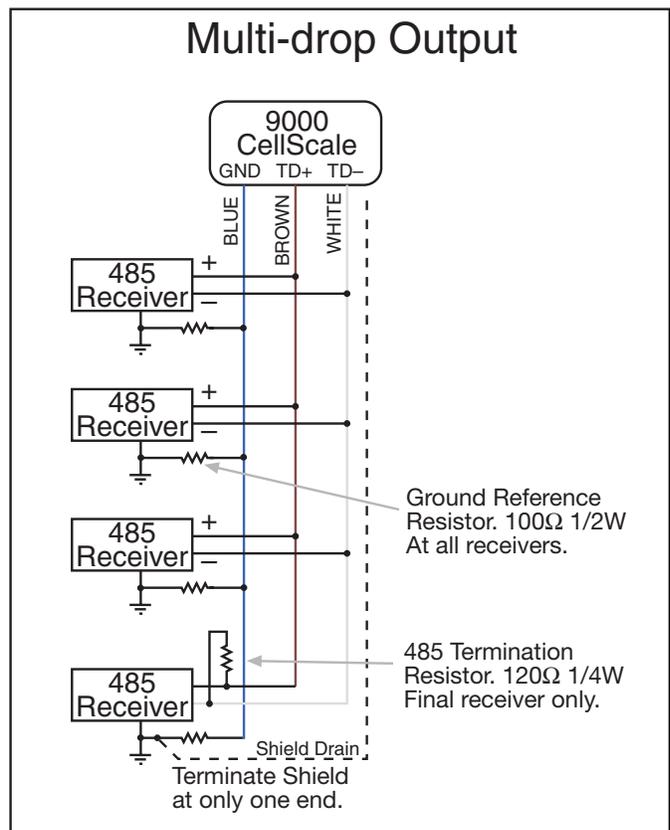
Black – RD+ (A)

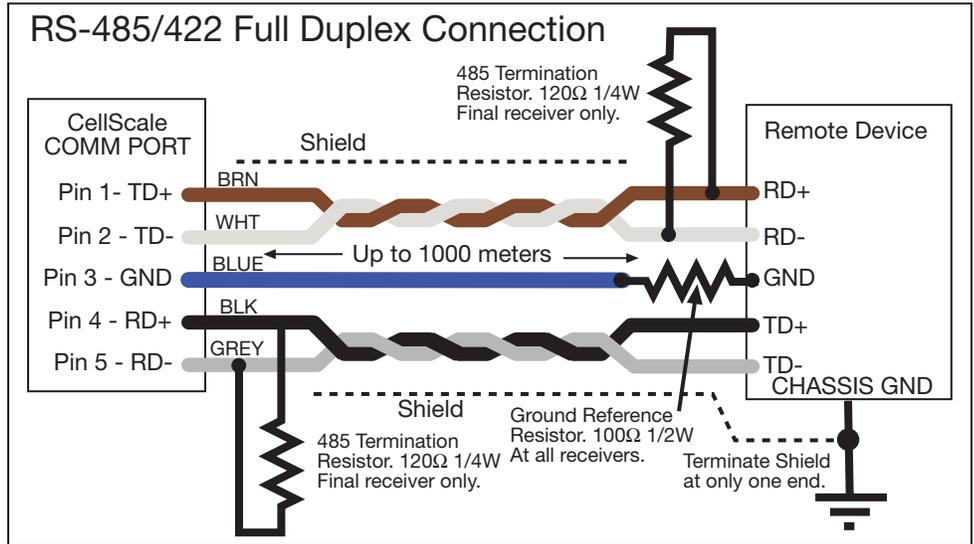
Grey – RD- (B)

Blue – Signal Ground

Drain Wire – Connect to metal shell.

If the CellScale is the final device in a chain, connect a 1/4W 120Ω resistor from RD+ to RD-. Terminating T connectors are available, contact MSI for details.

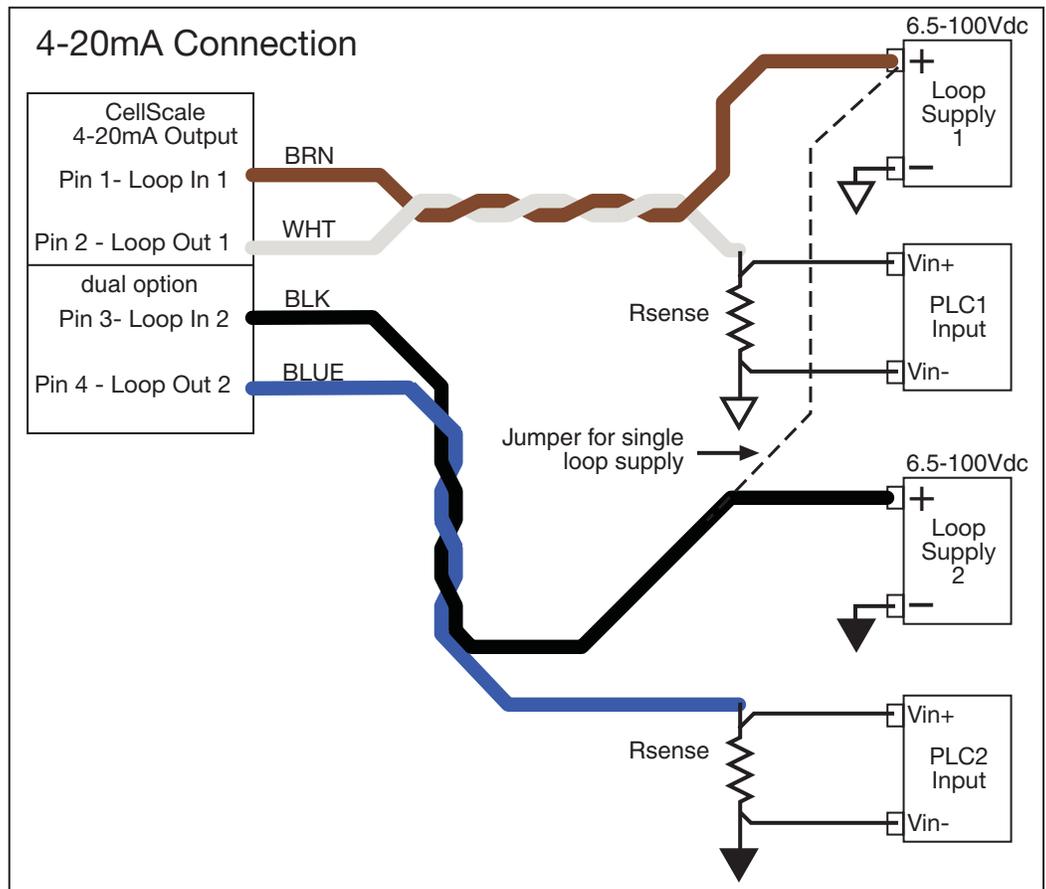




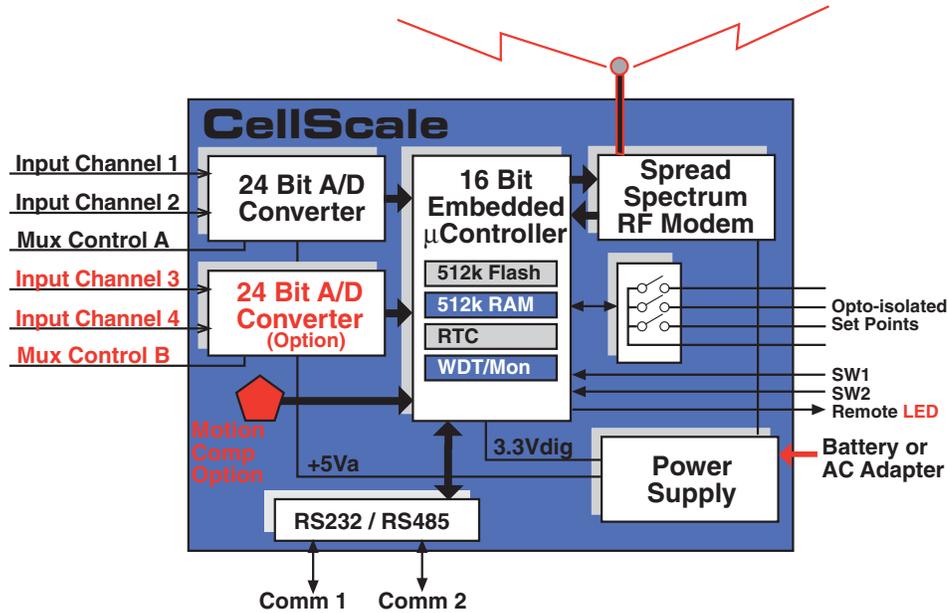
4-20mA Output Option

The 4-20mA Output Option (4m Cordset MSI P/N 12879) requires a loop supply input. Provide loop voltage (typically 24V_{DC}, but will operate from 6.5-100V_{DC}) to the Loop In pin. The minimum voltage is sense resistor dependent. The minimum loop voltage is equal to $(.02 * (R_{sense} + R_{wiring}) + 5V)$. If isolation is not a concern, the DC supply for the CellScale (9-30V_{DC}) can function as the 4-20mA Loop In supply. With the dual 4-20mA option, each output is isolated from chassis ground and each other, assuming separate loop supplies. For details on setting up the 4-20mA output(s), refer to page 89 in the calibration section.

- Brown – Loop In (Output 1), 6.5-100V_{DC}
- White – 4-20mA Loop Out (Output 1)
- Black – Loop In (Output 2, dual option only)
- Blue – 4-20mA Loop Out (Output 2)



CELLSCALE BLOCK DIAGRAM



The CellScale is based on a high performance embedded version of the 80186, the Am186ES which performs all control of the A/D converters, the I/O and interfacing to the Cellular Modem. The modem has a secondary microcontroller to handle RF traffic and controlling the hopping patterns.

The A/D converters are 24 bit Sigma-Delta converters with AC excitation capability. Each A/D has two independent inputs allowing multiple scale platform capacity.

The CellScale read only memory is Flash based allowing easy upgrades and software maintainability. The RAM memory is battery backed as is the Real-Time-Clock/Calendar.

An accelerometer based motion and tilt transducer is available as an option. This advanced capability offers a means to compensate motion and tilt for vehicle and other mobile weighing situations that conventional scales can't handle.

The Power Supply is designed for inputs from 9-30VDC. The supply is transient protected for direct vehicle power, or can run from any 12V SLA battery. Enough power is available to power up to forty 350 load cells.

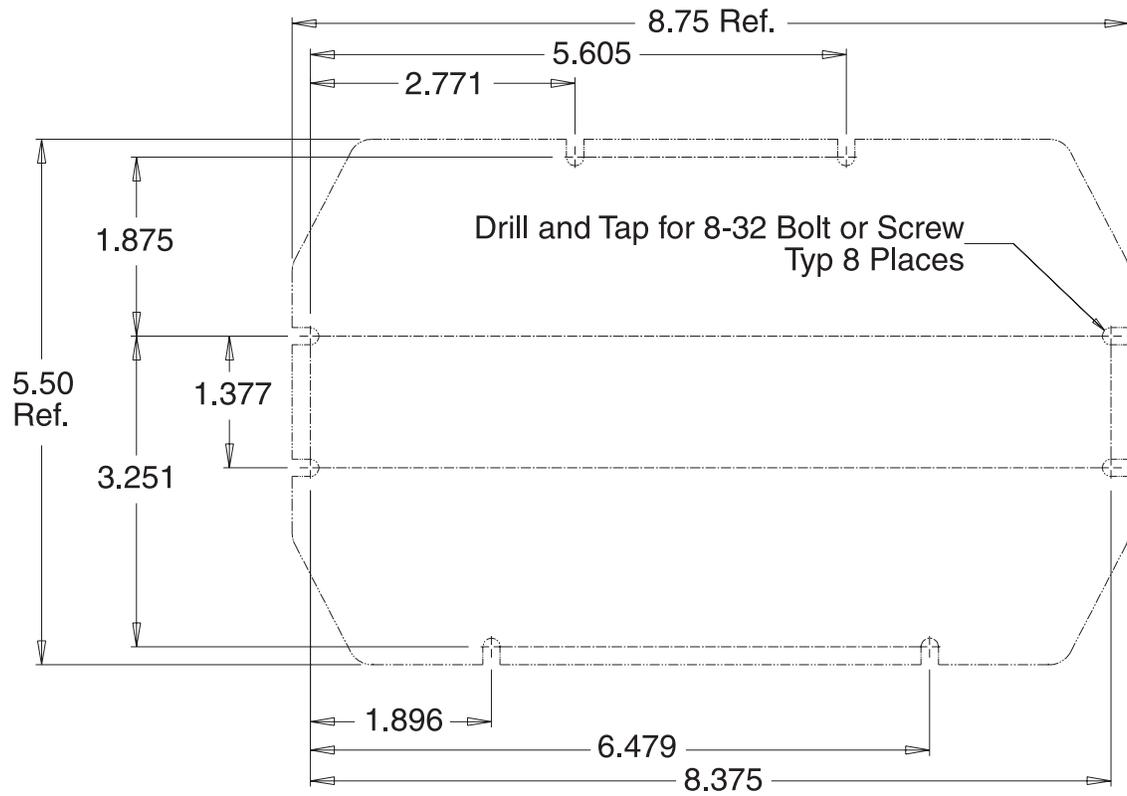
One user available comm port is available. Comm 1 is software configured as an RS-232 or RS-422/485 port. A second port is available in 9000s not equipped with the RF Modem.

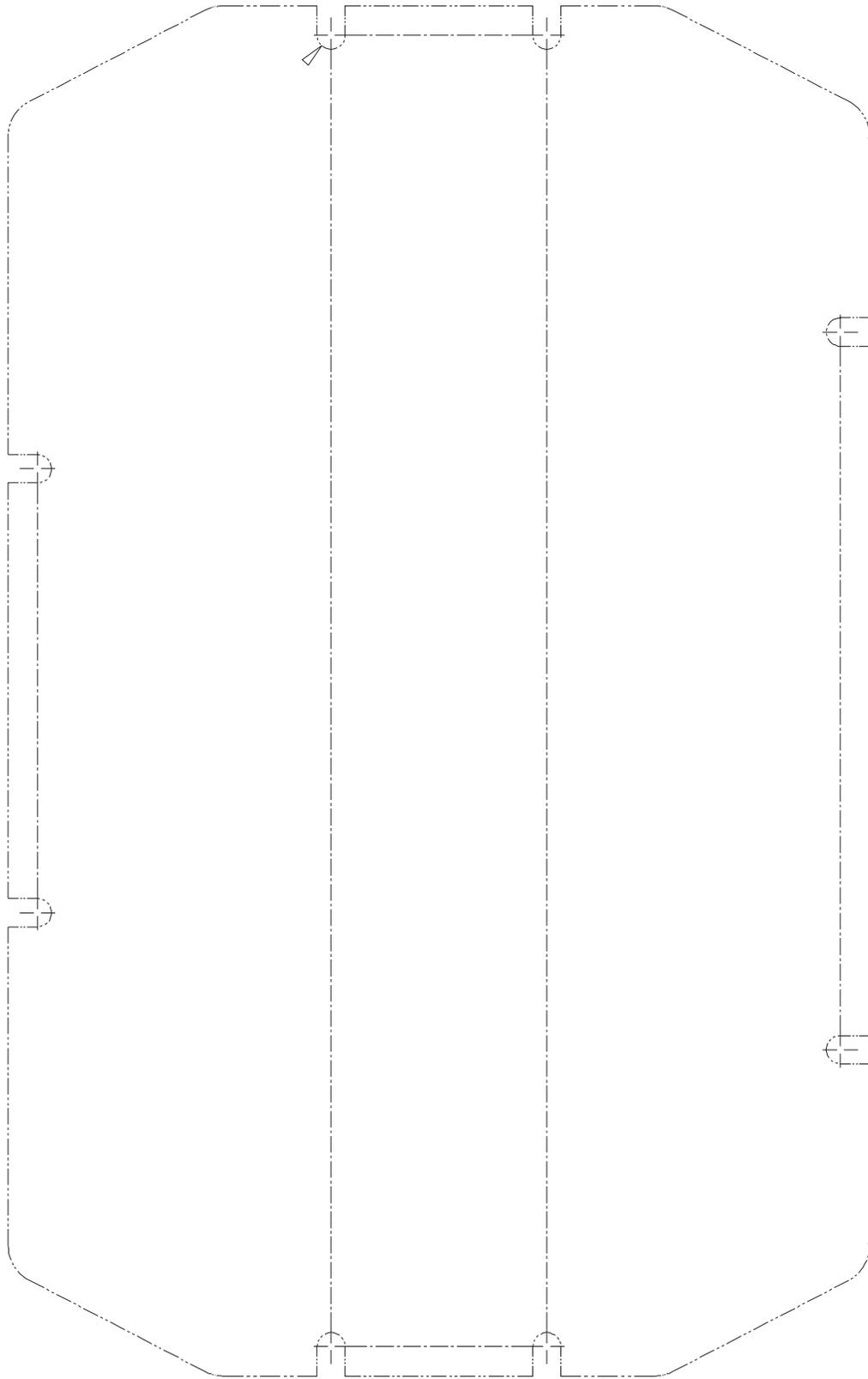
Three isolated outputs and 1 isolated input are provided for set points and trigger inputs. In addition, 2 programmable switches inputs are found on the Power connector.



CELLSCALE MOUNTING HOLES

Enlarge this template by 200%.







SECTION 2 – RF SCALE COMMUNICATIONS – THE CELLSCALE SYSTEM

INTRODUCTION

The 9000 CellScale is the key component of the MSI CellScale™ System. The CellScale system uses frequency hopping spread-spectrum RF Modem technology transmitting in the 2.4 GHz ISM band.

RF Modems have been problematic as the RF bands are very hostile, corrupted by noise, path loss and interfering transmission from other radios. Even in a pure interference-free environment, radio performance faces serious degradation through a phenomenon known as multipath fading, a problem particularly prevalent for indoor installations. Multipath fading results when two or more reflected rays of the transmitted signal arrive at the receiving antenna with opposing phase, thereby partially or completely cancelling the desired signal. Spread spectrum reduces the vulnerability of a radio system to both interference from jammers and multipath fading by distributing the transmitted signal over a larger region of the frequency band than would otherwise be necessary to send the information. This allows the signal to be reconstructed even though part of it may be lost or corrupted in transit.

Spectrum has been set aside at 2.4GHz in most countries for the purpose of allowing compliant spread spectrum systems to operate freely without the requirement of a site license. In the USA, there are absolutely no site licensing requirements. The CellScale system is also programmable for use in most European countries. Please contact MSI for worldwide compliance information.

NETWORK DESCRIPTION

The CellScale system uses frequency hopping which is produced by transmitting the data signal as usual, but varying the carrier frequency rapidly according to a pseudo-random pattern over a broad range of channels, in this case 86 discrete frequencies. These 86 frequencies are combined in different “hopping patterns” to provide 64 separate networks. The CellScale network uses a ‘Star’ network topology. One unit, usually the CellScale, is designated a ‘Master’. The Master transmits a sync pulse on a regular basis, providing synchronization of all remotes in the designated Network. Thus it forms the center of a cell. MSI provides three products capable of being the master unit: the CellScale, the 9300 Crane Scale, or the Trans-Weigh CS Crane Scale. Up to 16 remotes can access the master unit. Current MSI provided remote devices include the 3750CS Indicator, the 9750A Handheld Indicator, the 9850 Indicator, and the 9020 CellModem. Multiple remotes can coexist on one network, or can be easily switched to other networks as required.

The CellScale system uses TDMA (Time Division Multiple Access) to arbitrate between multiple remotes. Each remote is assigned a specific time slot thus guaranteeing data throughput.

NETWORK EXPANSION

You can expand your system with virtually unlimited combinations of additional CellScales™, CellModems, and CellScale Indicators (3750CS, 9750, and 9850).

You can also expand your system with any component that features an RS-232/422/485 input/output (I/O) port: desktop/laptop computers, printers, scoreboards, relay boards and many others.

There are three ways to connect additional components to your cellular weighing network.

- 1) Via MSI-3750CS or 9850 Indicators:

RS-232 components can be linked directly to the Indicator Comm Ports with a cable. The 9850 offers two available Comm ports, one of which is software configurable to RS232/422 or 485. The 3750CS offers 1 RS-232 port.

- 2) Via CellModem, MSI-9020:

Components can be linked to a remote radio modem, the MSI-9020 CellModem. It enables wireless cellular communication with CellScales™ and the rest of your cellular weighing network. CellModems are linked via RS-232/422 to peripheral equipment. If necessary, a USB to serial converter can be used for Computers not equipped with RS-232 serial ports. MSI recommends Keyspan™ products such as the USA-19HS for this purpose.

- 3) Via CellScale™:

Each CellScale™ provides an I/O to connect directly to other system components. CellScales™ are linked via RS-232/422/485 to peripheral equipment. Generate printed and electronic reports automatically for

numerous load sensors; send weight data automatically from numerous load sensors to a computer database; cross reference shipments with inventory; track product flow; monitor shelf life; and unlimited others.

ANTENNAS

To meet FCC licensing rules, you must use only antennas supplied or recommended by MSI. MSI offers the CellScale with six antenna choices: 1) Standard Antenna – This is a small 1/2 wave antenna that mounts directly on the 9000 CellScale enclosure and is suitable for most short to medium range applications. 2) Long Range Antenna – A high gain antenna that is remotely mounted from the 9000 with a low loss coaxial cable. This omnidirectional antenna increases the range up to 4 times. The 10' cable allows placement of the antenna above the 9000 for ease of clearing possible obstacles to data transmission. 3) Vehicle Mount Whip Antenna – This antenna mounts directly to the roof of mobile vehicles and is weatherproof. 4) For maximum range, a 14dBi Gain Yagi Antenna is available by special order. Please contact MSI for details. 5) Corner Reflector – Often the best choice for a wall mounted antenna. MSI offers a 14dBi and a 9dBi Corner Reflector. 6) Patch Antenna – For applications where the standard antenna is vulnerable to physical use or outdoor applications. The Patch antenna is mildly directional which requires more care in antenna placement for long range applications. Patch Antennas are available by special order only.

Antenna placement is critical to problem free use of your CellScale system.

- 1) Be sure a relatively clear transmission path exists between the 3750CS and associated CellScale master devices. The radio signals travel primarily by line of sight (LOS), and obstructions between stations will degrade the system performance. LOS is less important as distances decrease.
- 2) When using the long range antenna, mount the antenna on a tower or other elevated structure to ensure that you have a clear LOS transmission path. This will raise the antenna to a level sufficient to clear surrounding terrain and other obstructions. It is not necessary or desirable to provide a ground plane for the antenna.
- 3) Never use a directional antenna (e.g. a Yagi, or a corner reflector) on a mobile system. However, fixed station locations can often benefit from directional antennas when the location of the other components of the RF network are always in the same general direction.
- 4) If using the meter mounted standard antenna, ensure that the antenna is not blocked by any metal. Transmission is good through most kinds of glass so mounting a meter next to a window should work fine. If there is no clear line of sight place to mount the 3750CS, consider switching to the long range antenna so the antenna can be remoted.
- 5) The standard and long range antennas are vertical plane devices. Do not mount them sideways. They should always point up. It also works to point them down, when high off the ground (such as on the underside of a large bridge crane). The long range 9dBi Antenna is particularly sensitive to off axis mounting. Use a carpenter's level to ensure the antenna is exactly 90° perpendicular to the earth.
- 6) Do not mount an omnidirectional Antenna next to a metallic or concrete surface. This can result in reflections and undesired RF characteristics. For this application, use a Corner Reflector.
- 7) After installation, you must seal the Antenna connection with an Adhesive Heat Shrink Boot. Failure to seal the Antenna may result in liquid destroying the Antenna, or the CellScale.

MSI does not recommend extending the coaxial cable beyond 3 meters. At 2.4GHz more loss will result from coax losses than are gained by raising the antenna. If you must extend the antenna, use a very low loss 50Ω coax such as RG-214 low loss varieties. For very short extensions (<1m), cables made with RG-316 are suitable.

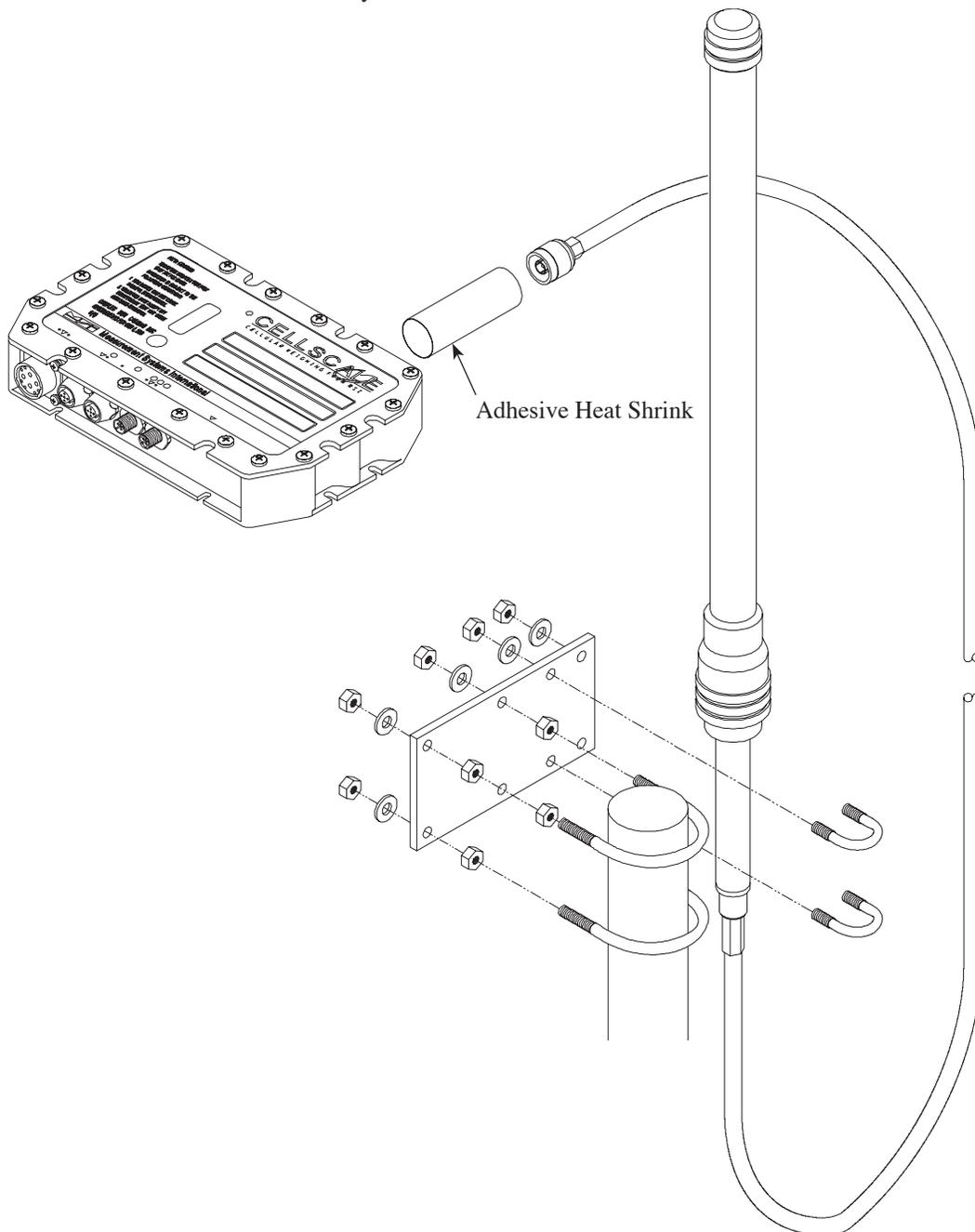
FCC STATEMENT

FCC ID: HSW-2450M

Note: This unit has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their expense.

STANDARD ANTENNA

The Standard Antenna (pictured here) is an articulated 1/2 wave 2dBi gain design with a standard TNC connector. This antenna and Coax connector, though resistant to water, is not water-proof. Seal the TNC base with an adhesive heat shrink boot if this antenna is exposed to rain. This Antenna should be vertically oriented.



LONG RANGE OMNI 9dBi ANTENNA W/ PIPE MOUNT

The Long Range Omnidirectional antenna (MSI P/N 12147) is pole mounted (up to 2" diameter) and extends the range of CellScale transmissions. MSI supplies this antenna with a 10' (3m) coax cable pre attached. This antenna must be vertically mounted. The vertical Beamwidth (-3dB point) is 14 degrees. Also available with an N connector (MSI P/N 12037) for applications requiring longer coax cable lengths.

YAGI ANTENNA

A highly directional YAGI Antenna is available by special order. This antennas offers both high gain (14dBi) and controllable transmission patterns. This antenna must be carefully aligned for long distance applications. The Beamwidth of the Yagi is 30° Elevation, and 34° Azimuth. The Yagi is mast mounted for masts up to 2-1/8" (5.4cm) in diameter. The Yagi is connected to CellScale equipment with adapter coax P/N 12751 (6', longer lengths available by special order).



14 dBi Yagi

CORNER REFLECTOR ANTENNAS

Two Corner Reflector Antennas are available by special order. These antennas offer both high gain and controllable transmission patterns. These antennas are the best choice when antenna placement is against a wall or other surface. These antennas come with a Pipe mount for pipe up to two inches (5cm) in diameter. Standard Coax cable length is 3m (9' 10").

The 14dBi Model (MSI P/N 13204) features a Beamwidth of 44° Elevation, and 35° Azimuth.

The 9dBi Model (MSI P/N 13205) has a Beamwidth of 75° Elevation, and 65° Azimuth. These must be used with adapter coax P/N 12751 (6', longer lengths available by special order).



14 dBi Corner Reflector



9 dBi Corner Reflector

VEHICLE MOUNT WHIP ANTENNA

A vehicle mount whip antenna is approved for use with MSI CellScale equipment and is available by special order. This 5 dBi gain whip is rugged and waterproof and mounts in a 3/4" hole on the roof of mobile vehicles. MSI P/N 13206 (Antenna) and P/N 13207 (mount). The mount includes 17' of low loss coax terminated in a TNC Connector.



5 dBi Vehicle Whip



STANDARD ANTENNA BULKHEAD EXTENSIONS

MSI offers short Coaxial cable assemblies to extend the antenna connector when the CellScale equipment is mounted in an industrial enclosure. These Coaxial assemblies are designed for 2.4Ghz use and have TNC Male connectors at both ends. These mate with a through panel TNC to TNC Bulkhead Adapter.

TNC to TNC Flange Mount Bulkhead Adapter – MSI P/N 13140 TNC to TNC Jam Nut Mount Bulkhead Adapter – MSI P/N 13141

Extension Coax Cable Assemblies –

1' (30cm) P/N 13142, 2' (61cm) P/N 13143, 3' (.9m) P/N 13144, 4' (1.2m) P/N 13145

OTHER ANTENNAS

Other antennas are available for special applications. One antenna MSI often uses is a small Patch antenna. This antenna is suitable for rugged applications where standard antennas will often be destroyed. This is the antenna used in our Crane Scales. Special antennas for rugged applications, or long range transmission are available. Contact MSI for more information.

FCC'S MPE REQUIREMENTS

Information to user/installer regarding FCC's Maximum Permissible Exposure (MPE) limits.

Standard 1/2 Wave Dipole, Patch Antenna, Vehicle Whip, or Long Range 9dBi Omni: The field strength radiated by any one of these antennas, when connected to MSI RF products, may exceed FCC mandated RF exposure limits. FCC rules require professional installation of these antennas in such a way that the general public will not be closer than 20 cm from the radiating aperture of any of these antennas. End users of these systems must also be informed that RF exposure limits may be exceeded if personnel come closer than 20 cm to the apertures of this antenna.

Corner Reflectors or 15dbi Yagi: The field strength radiated by any one of these antennas, when connected to MSI RF products, may exceed FCC mandated RF exposure limits. FCC rules require professional installation of these antennas in such a way that the general public will not be closer than 2 m from the radiating aperture of any of these antennas. End users of these systems must also be informed that RF exposure limits may be exceeded if personnel come closer than 2 m to the apertures of either of these antennas.

SECTION 3 – TERMINAL ACCESS MODE

One way to setup, control, calibrate, and receive data from a CellScale is using a terminal program through Comm Port 1. Tested terminal programs that function well with the CellScale include ProComm Plus, Qmodem, HyperTerm (shipped with many versions of Windows), WinTerm, and ZTerm or Microphone (for Macintosh). Usually a VT102 emulation is used. All commands are single letter except when entering data.

Settings for your terminal program are: 9600 baud, 8 bit, 1 start bit, 1 stop bit, no parity, Handshaking usually not required, but you can turn on Xon/Xoff if you desire.

The Terminal access mode is initiated by connecting a terminal to Comm Port 1. The Terminal Access Mode should start. Refresh the display by pressing **[Return]** (generates CR/LF). This will bring up the Main CellScale Menu.



If you are unable to connect to the 9000, the 9000 might be in its “Host” mode. To force the Terminal Access Mode, type ;MSI9MSI9 [Return] Start with a semicolon “;”. The “MSI” must be capitals. Host mode baud rates might have been changed, so match baud rates of the current connection.

DIALOG BOXES

The CellScale will place dialog boxes on the terminal screen in response to several stimuli. Overloads, set points and other events will cause a dialog box to appear. Push **ESC** to remove the dialog box. The box will reappear in 45 seconds if the condition has not changed.

MENU CONVENTIONS

Make a menu selection with designated numbers or letters. A few critical menu selections require that case is correct, but most commands work with upper or lower case characters.

Data entry for numeric values are terminated with the return key on your terminal. Data entry for channel names and ID names are terminated with the return key. Data entry for strings are terminated with the ESC (escape) key.

Menus are entered with numbers or letters and are left with the escape key **[ESC]**. Each menu is numbered in the lower left corner of your terminal screen. The Main CellScale Menu is number 0001. All submenus have numbers. The sequence of numbers shows the ‘path’ the menu was reached by. Some menus have a menu depth of 3, 4, or 5 levels. Again, the use of the escape key will allow you to return to any level. The menu numbers are not illustrated in this manual, but are present in every menu screen.

Use the menu numbers when contacting Customer Support to report problems or ask questions.

Brackets [] are used to indicate keys that should be pressed while using the Terminal Access Mode. Text strings are indicated with quotes “tttttttxtttt”. Do not type the quotes. **[Return]** indicates the return key on your keyboard (sometimes referred to as enter) and is used to complete the entry of menu items (not strings) when more than 1 number or letter is required.

MENU SCREEN ILLUSTRATIONS

The main and secondary menus are all illustrated here. For those menus with simple purpose, the operational procedure will be explained. For some more complex functions, the text will refer you to subsequent chapters on the proper use of the menu.



Main CellScale Menu

```

----- MSI 9000 - CellScale -----
- (c) 2006 Measurement Systems International -
-----

13:48:06                                03/25/06

(1)   Channels/Calibration
(2)   Communications
(3)   Display
(4)   Feature Locks/Passwords
(5)   Product IDs
(6)   Set Points
(7)   System
(8)   About...

Enter choice :
```

- 1) Channels/Calibration – Calibration, channel setup, measurement parameters.
- 2) Communications – Set up Network Parameters for the RF Modem. Set data interface types for other Comm Ports. Program print strings
- 3) Display – Display weight, statistics, ID data.
- 4) Feature Locks/Passwords – Lock calibrations and other setups with password protection.
- 5) Product IDs – Setup IDs for storing totals and statistics.
- 6) Set Points – Program up to 32 Set Points with dual thresholds and messages.
- 7) System – Program LEDs, Battery power levels, and program the user keys SW1 and SW2. Provides hardware tests. Initializing of all registers.
- 8) About – Information on Software version. Provides hardware serial number.

Main CellScale Menu → (1) Channels/Calibration

```

***** Channel Setup *****

(1)   Channel Calibration
(2)   Data backup
(3)   Filter (software)
(4)   Channel Scanlist functions
(5)   Motion Compensation
(6)   Motion Detection
(7)   Tare
(8)   Total
(9)   Units Lock
(a)   Zero
(b)   Standard Mode: Industry
(c)   4 to 20mA
(ESC) Exit
```

- 1) Calibration – Start the Calibration Routine. See section 7 for details on calibration.
- 2) Data Backup – Provides method to back up calibration and retrieve calibration parameters.
- 3) Filter (software) – Provides user access to filtering. Use this menu to add additional filtering for harsh measurement environments.
- 4) Channel Scanlist functions – Add and delete channels from the scan list. Program channel type, channel name, and scan list position. Make channels active or in-active. Assign AC or DC excitation. Change conversion speed.
- 5) Motion Compensation – Used only for CellScales equipped with the motion compensation option.
- 6) Motion Detection – Program parameters related to motion detection. When the scale is in motion, zero, tare, and total functions are disabled. This menu sets parameters to control the motion window (how many ‘d’ change constitutes motion) and how long the scale must remain stable before the motion flag is

removed from the data.

- 7) Tare – Setup tare options such as Auto clear, universal tare mode, and set tare for every ID programmed for the set channel.
- 8) Total – Setup total modes and total thresholds.
- 9) Units Lock – Define available measurement units.
- a) Zero – Setup zero parameters and AZM (Auto Zero Maintenance). Apply zero offsets for special applications.
- b) Industry Standard – Set the Legal-for-Trade modes. This menu is not present on some CellScale configurations.
- c) 4 to 20mA – Configure the optional 4-20mA module. Sets target channel and 4mA (zero) and 20mA (span) settings of the option output.

Main CellScale Menu → (1) Channels/Calibration → (1) Calibration

See Section 3 – Scan Lists for information on the channel setups. See Section 6 – Calibration for instructions using the Calibration submenus.

Main CellScale Menu → (1) Channels/Calibration → (2) Data backup

```

***** Data Backup *****

(1) Backup data after every cal:          Yes
(2) Restore from ROM every power up:     No
(3) Restore from ROM including Remote and Math loadcells: Disabled
(b) Backup data NOW!
(r) Retrieve backup data NOW!
(ESC) Exit
    
```

- 1) Backup data after every cal – Choosing ‘Yes’ causes the CellScale to transfer all calibration data in the Flash memory after every calibration procedure. Choosing ‘No’ will mean the most current calibration is only saved in battery backed RAM. In this case if you were to update the program, calibration would be lost. The reason to select ‘No’ is if you wanted to try recalibrating without the risk of losing the previous calibration. Therefore, if the cal did not work out, the previous cal can be restored by using ‘r’ from this menu.
- 2) Restore from ROM every power up – Needed if the internal battery goes bad.
- 3) Restore from ROM including Slave Scales and Math Channels – Same as 2 except data will also be retrieved for Slave Scales and Math channels.
- b) Backup data NOW! – Copies current Cal data into the flash ROM. If you are not backing up the cal data after every cal, this will backup the cal manually.
- r) Retrieve backup data NOW! – Replaces current RAM cal data with data from the Flash ROM.

Main CellScale Menu → (1) Channels/Calibration → (3) Filter (software)

```

***** Software Filter setup *****

(1) Choose the Channel to change:        1-2
(2) Software filter setting is:          None
(3) Motion compensation Hi end filter:   4 %
(4) Motion compensation Lo end filter:   2 %
(ESC) Exit
    
```

- 1) Push 1 to select channel in current scanlist.
- 2) Software Filter Setting – Choose none, low, or high filters. The high filter responds slower, but provides additional smoothing for high vibration applications.
- 3) Used for the Motion Compensation Option
- 4) Used for the Motion Compensation Option



Main CellScale Menu → (1) Channels/Calibration → (4) Channel scanlist functions

```

***** Channel ScanList *****

(1)   Add a specific channel-subchannel
(2)   Delete a scanList entry
(3)   Edit a scanList entry
(4)   Move a scanList entry
(ESC) Exit
-----

Position = ch-subch, * indicates channel is active

  1 = 1-1      9 = ---      17 = ---      25 = ---
  2 = ---     10 = ---     18 = ---     26 = ---
  3 = ---     11 = ---     19 = ---     27 = ---
  4 = ---     12 = ---     20 = ---     28 = ---
  5 = ---     13 = ---     21 = ---     29 = ---
  6 = ---     14 = ---     22 = ---     30 = ---
  7 = ---     15 = ---     23 = ---     31 = ---
  8 = ---     16 = ---     24 = ---     32 = ---

```

ScanList is covered in detail in Section 5 –

Main CellScale Menu → (1) Channels/Calibration → (5) Motion Compensation

This menu will not appear if the Accelerometer Option is not installed.

```

***** Motion Compensation Setup *****

(1)   Choose the Channel to change:      1-1
(2)   Motion/Angle compensation:        Disabled
(3)   Motion/Angle compensation mode:   Actual
(4)   MSI component weight:             70.   Pounds
(5)   User component weight:            0.    Pounds
(6)   Setup/calibrate the accelerometer: Un-cal'd
(ESC) Exit

```

Motion Compensation requires the Motion Compensation option installed. Use of this menu is covered in Section 7 – Calibration.

Main CellScale Menu → (1) Channels/Calibration → (6) Motion Detection

```

***** Motion Detection Setup *****

(1)   Choose the Channel to change:      1-1
(2)   Motion detection:                  Enabled
(3)   Motion detection band:             0
(4)   Time period to detect motion:      1000 msec
(ESC) Exit

```

Motion detection is covered in detail in Section 6 – Calibration

Main CellScale Menu → (1) Channels/Calibration → (7) Tare

```

***** Tare setup *****

(1)   Choose the Channel to change:      1-1
(2)   Auto clear:                        Disabled
(3)   Motion check:                      Enabled
(4)   Universal tare mode:               Disabled
(5)   Universal tare weight:             0.    Pounds
(6)   Product ID (# 1):                  Product1
(7)   Product ID tare weight:            2205. Pounds
(8)   Current weigh mode:                Gross
(ESC) Exit

```

This menu sets the Tare parameters for any channel.

- 1) Input channel and sub channel for this tare parameter setup.
- 2) Auto clear: Enabling “Auto Clear” causes the CellScale to clear the Tare Value after each lift greater than 0 NET. The Tare Value is cleared and the display mode reverts to Gross Weight once the load is removed (the weight goes below 0 NET). The “ON TOTAL” setting clears the Tare Value after the load is totaled. The default for the “AUTO CLR” function is “DISABLED” . When disabled, the Tare Value can only be cleared manually.
- 3) Motion check: when enabled, auto tares are prevented unless the scale reading is stable within the motion parameters.
- 4) Universal tare mode: when enabled, all ID codes assigned to this channel will share the same tare value.
- 5) Universal tare value: Set the value of the universal tare.
- 6) Select target Product ID.
- 7) Set Tare weight for this product ID.
- 8) Current weigh mode: toggles between net and gross if a tare value is established for target ID.

TOTAL

The CellScale has extensive totalizing capabilities. The total provides data for many applications such as loading and filling or productivity. The CellScale also calculates statistics from the total data. This provides Min, Max, Average, # of samples, Standard Deviation, and coefficient of variance data in addition to the total.

Main CellScale Menu → (1) Channels/Calibration → (8) Total

```

***** Total Setup *****
(1)   Choose the Channel to change:      1-2
(2)   Dialog box display time           10 sec
(3)   Mode:                             Disabled
(4)   Motion check:                     Enabled
(5)   Time with no motion before total:  0 msec
(6)   'Rise above' threshold:           11 %
(7)   'Drop below' threshold:           10 %
(ESC) Exit

```

- 1) Push **[1]** to change the input channel and sub channel for Total setup.
- 2) Controls the length of time a dialog box will appear on the terminal interface. Only affects the terminal program.
- 3) Total Mode – Push **[3]** to bring up the Total Mode menu:

```

***** Set Total Mode for channel 1-2 *****
(1)   Disabled
(2)   AutoLoad
(3)   AutoNorm
(4)   AutoPeak
(5)   Manual
(6)   Load/Drop
(ESC) Exit

```

[1] Disabled – Totals turned off.

[2] AutoLoad – Any settled weight above the ‘Rise above’ threshold will be automatically totaled. Then the scale must fall below the ‘Drop below’ threshold before another total is allowed.

[3] AutoNorm – This mode takes the last settled weight to auto total with. The total occurs only once the scale goes below the threshold. This allows the load to be adjusted without a total occurring. Once the load is gone, the scale uses the last settled reading for total.

[4] AutoPeak – Similar to the AutoNorm mode except the scale uses the highest settled reading. Useful for loads that can’t be removed all at once.



[5] Manual – Requires the operator pushes a button to total the current load. This button can be a programmed external switch on the CellScale, the Total F key on any 3750CS, or the external cabled total switch found in the External Total Switch option.

[6] Load/Drop – This is a special autototal mode for use with the External Total Switch option. When the operator pushes the button, the CellScale performs a long-term average of the load, until it detects the load has dropped below the threshold. This provides higher accuracy in weighing bulk materials while in motion.

Make the Total Mode selection by pushing the appropriate key. In this example we'll pick "Autoload" by pressing [2]. Once the selection is made you are returned to the "Total Setup" menu.

```

***** Total Setup *****
(1)   Choose the Channel to change:      1-2
(2)   Dialog box display time           10 sec
(3)   Mode:                             Autoload
(4)   Motion check:                     Enabled
(5)   Time with no motion before total:  0 msec
(6)   'Rise above' threshold:           11 %
(7)   'Drop below' threshold:           10 %
(ESC) Exit

```

- 4) Motion Check - If enabled, the scale must have settled weight before it will totalize. The motion check should always be enabled for the autototal modes (Autonorm, Autopeak, Autoload) for accurate weighing. Disabled motion check allows the user in manual totalizing modes to ensure the current weight is totaled.
- 5) Time with no Motion before total - Allows the user to set a minimum time that the weight must be settled before any total can occur. Program time up to 10000 ms (10 seconds).
- 6) 'Rise above' threshold - This parameter sets a threshold expressed in per cent of channel capacity that the weight must rise above before totalizing can occur. This threshold prevents double totalizing of the same weight by requiring a weight shift between totaled weighments. The default value is 11% which, for example, represents 1100 pounds on a 10000 pound scale. The rise above threshold must always be greater than the 'fall below' threshold.
- 7) 'Drop below' threshold - After a total has occurred, the weight must fall below this threshold (again expressed as a per cent of capacity) before another total can occur. In the Autonorm and Autopeak modes the actual total occurs when the weight drops below this threshold. The default value is 10%. The 'fall below' threshold must be lower than the rise above threshold.

Main CellScale Menu → (1) Channels/Calibration → (9) Units Lock

```

***** Units Lock *****
(1)   Pounds:                           Un-Locked
(2)   Kilograms:                        Un-Locked
(3)   Tons:                             Un-Locked
(4)   Metric Tons:                      Un-Locked
(5)   Ounces:                           Locked
(6)   Grams:                            Locked
(7)   Deka-Newtons:                    Un-Locked
(n)   Choose the Channel to change:      1-1
(ESC) Exit

```

The Units Lock menu allows the user to enable and disable available units. This menu affect the operation of the units key on any connected 3750CS as well as keyboard and auxiliary keys programmed to function as units keys. Each number key in this menu toggles the associated unit from Locked to Un-Locked. Certain units remain locked depending on capacity of the selected channel. The CellScale follows these rules: No ounces or grams above 250 lb. capacity, no Tons or metric tons below 500 lb. capacity. If capacity > 1,000,000 lb. lock out all units except kg, tons, and metric tons. If capacity is > 2204619 lb. then only , dan, tons and metric tons function. If capacity >2238080 lb. then dan is locked out.

Use the 'n' key to select other channels from the current scan list.

Main CellScale Menu → (1) Channels/Calibration → (a) Zero

```

***** Zero setup *****
(1)   Choose the channel to change:      1-1
(2)   Automatically zero at power up:    Disabled
(3)   AZM (auto zero maintenance):      Enabled
(4)   AZM range (0=1/2, 1-255):         1 d
(5)   AZM time between checks:          1000 msec
(6)   Current zero offset:               0.
(7)   Positive Zero range (+1 to +100%) 100%
(8)   Negative Zero range (-1 to -20%)  -20%
(9)   Power Up Pos Zero range (+1 to +25%) 25%
(a)   Power Up Neg Zero range (-1 to -20%) -20%
(b)   Zero Math Inputs: Disabled
(ESC) Exit

```

The Zero Setup menu is used to adjust the AZM parameters and to add zero offset for special application. AZM is discussed in detail in the calibration section. Do not change the AZM settings without reading and understanding their impact on weighing.

The zero offset is used to add a weight offset to zero. For example, setting 100kg in the zero offset register will cause the weight to return to 100kg when the channel is zeroed (instead of zero). The intent of this feature is for safety applications where the weight of the scale must be included.

This menu also provides for setting the zero range as a per cent of capacity, and the Automatic zero range that is enacted when the scale is first turned on (enabled by selection 2).

Main CellScale Menu → (2) Communications

The Communications Setup menus are discussed in detail in Section 4.

Main CellScale Menu → (3) Display

```

***** Main Display Menu *****
(1)   Change the channel being displayed: 1-2
(2)   Define a key function (Keys 5-9)
(3)   Define a display type (Display A-E)
(4)   Display a single value

(5)   Undefined
(6)   Undefined
(7)   Undefined
(8)   Undefined
(9)   Undefined
(ESC) Exit

A:    Current weight:          432 Kilograms   Grs
B:    Tare weight:             167 Kilograms
C:    Net weight:              265 Kilograms
D:    Undefined:
E:    Undefined:

Stable      Not OK to total    Not COZ

```

The Main Display Menu provides monitoring of any data generated by any channel. Intended mainly for confirming proper setup and calibration rather than functioning as a scale, this menu provides much of the functionality of a Weigh Meter. You can define 5 weight display types and define 5 scale keys.

- 1) Select channel to display from current scan list.
- 2) Brings up list of functions that you assign to keys 5-9.
- 3) Brings up list of display types (2 pages) that you assign to display A-E.



Main CellScale Menu → (3) Display → (2) Define a key function

```

***** Change a Display Key Menu Function *****

(n)   Menu key to configure is:   5, Undefined
(ESC) Exit

Type new value for menu key  5  and hit (ENTER)

1) Zero                               13) Tare; Automatic
2) Calibrate                          14) Tare; Numeric Entry
3) Find Remote CellScale              15) Test
4) Net/Gross                          16) Total; Auto On/Off
5) Peakhold                          17) Total; Manual Command
6) Power Down                        18) Total; Clear Last
7) Print                             19) Total; Clear This ID
8) Product ID                        20) Total; Clear All IDs
9) Serial Data String #1             21) Total; View
10) Serial Data String #2            22) Units Change
11) Set Point; Clr Latch              23) Undefined
12) Set Point; Configure

```

Main CellScale Menu → (3) Display → (3) Define a Display Type

```

***** Change a Display Type Menu *****

(n)   Display to configure is:   A, Weight; Current:
(p)   Show next page of values
(ESC) Exit

Type a new value for display  A  and hit (ENTER)

1) Weight: Current                    11) # Totals, This ID
2) Weight: Gross                      12) # Ttls, w/in, This ID
3) Weight: Net                        13) # Ttls, Above, This ID
4) Weight; Peak Gross                 14) # Ttls, Below, This ID
5) Weight; Peak Net                  15) # Totals, All IDs
6) Weight; Tare                      16) # Ttls, w/in, All IDs
7) Weight; Total This ID              17) # Ttls, Below, All IDs
8) Weight; Total All IDs               18) # Ttls, Above, All IDs
9) Weight; Total Last                 19) Product ID Name
10) Weight; Zeroed                    20) Product ID Number

```

Main CellScale Menu → (3) Display → (3) Define a Display Type → (p)

```

***** Change a Display Type Menu *****

(n)   Display to configure is:   A, Weight; Current:
(p)   Show next page of values
(ESC) Exit

Type a new value for display  A  and hit (ENTER)

21) Stat:Avg Wt, This ID              31) Stat:Min Wt, All IDs
22) Stat:Co Var, This ID              32) Stat:Std Dev, All IDs
23) Stat:Lst Max, This ID             33) A/D Counts; Decimal
24) Stat:Lst Min, This ID             34) A/D Counts; Hex
25) Stat:Max Wt, This ID              35) Percent of A/D
26) Stat:Min Wt, This ID              36) Percent of Bar Graph
27) Stat:Std Dev, This ID             37) Percent of Capacity
28) Stat:Avg Wt, All IDs              38) Undefined
29) Stat:Co Var, All IDs
30) Stat:Max Wt, All IDs

```

The Display Type Menu is configured much the same as the Function keys menu. Use 'n' to assign the display type location (A-E), then type the one or two digit number corresponding to the display type desired for the location. For example assign Gross weight to A, Net weight to B, and Tare weight to C. Statistics and other

parameters can easily be confirmed by assigning them to display locations. Us 'p' to see the second page of weight types.

Main CellScale Menu → (4) Feature Locks / Passwords

```
**** Feature Locks/Passwords Setup ****

(1) Calibration
(2) Channel menu
(3) Communications
(4) Product ID menu
(5) Radio menu
(6) Set Points menu
(7) Strings menu
(8) Individual Features
(ESC) Exit
```

Main CellScale Menu → (4) Feature Locks / Passwords → (1) Calibration

```
**** Calibration Lock ****

(1) Calibration password is:      None
(2) Calibration is:              Un-Locked
(ESC) Exit
```

This menu is typical of all the lock menus. You can assign a separate password to any major feature.

Main CellScale Menu → (5) Product IDs

```
**** Product Data ****

(1) Show the next ID
(2) Show the previous ID
(3) Find/Create an ID
(4) Show parameters for this ID
(5) Show statistics for this ID
(6) Show summary of all IDs
(ESC) Exit
*****

(a) Product ID (# 2) name:
(b) Input Channel (1-2) name: .....
(c) Status: Active
(d) Units: Kilograms
(e) Tare weight: 167. Kilograms
(f) Total weight: 0. Kilograms
(g) # of totals: 0
(h) String 1: -----
(i) String 2: -----
```

The setup and programming of Product IDs is covered in section 5.



Main CellScale Menu → (6) Set Points

```

***** Set Points *****

(1)   All set points are:           Disabled
(2)   Clear latch
(3)   Setup overhead
(4)   Setup outputs
(5)   Setup values
(ESC) Exit

Set point status

  1 = Disab    9 = Disab    17 = Disab   25 = Disab
  2 = Disab   10 = Disab   18 = Disab   26 = Disab
  3 = Disab   11 = Disab   19 = Disab   27 = Disab
  4 = Disab   12 = Disab   20 = Disab   28 = Disab
  5 = Disab   13 = Disab   21 = Disab   29 = Disab
  6 = Disab   14 = Disab   22 = Disab   30 = Disab
  7 = Disab   15 = Disab   23 = Disab   31 = Disab
  8 = Disab   16 = Disab   24 = Disab   32 = Disab

```

The Set Points menus are discussed in detail in Section 7

Main CellScale Menu → (7) System

```

***** System *****

(1)   Clock
(2)   Initializations
(3)   LED Management
(4)   Switch Functions
(5)   System Power
(6)   Display Device: None
(7)   RF Modem Installed: Yes
(8)   Load New Application Software
(ESC) Exit

```

Main CellScale Menu → (7) System → (1) Clock

```

***** CLOCK *****

(1)   Set Time           (13:52:42 )
(2)   Toggle Time Mode  (24 Hour)
(3)   Set Date           (Tuesday,  January  14, 2003)
(4)   Reset the clock
(ESC) Exit

```

Main CellScale Menu → (7) System → (1) Clock → (1) Set Time

```

Current time (01 : 51 : 22) 24 Hour format.
Enter  time (HH : MM : SS) 24 Hour format. [ENTER]

```

Main CellScale Menu → (7) System → (1) Clock → (3) Set Date

```

Current date (01 : 14 : 2003)
Enter  date (MM : DD : YYYY)

```

Setting the time and date is straightforward. The date auto calculates the day of the week

Main CellScale Menu → (7) System → (2) Initializations

```

***** Initializations *****

(a)   Clear all calibration   data to defaults
(b)   Clear all product ID   data to defaults
(c)   Clear all registry     data to defaults
(d)   Clear all serial settings to defaults
(e)   Clear all set point settings to defaults
(f)   Clear all system settings to defaults

(Z)   Master reset

(ESC) Exit

```



The Initializations menu allows the operator to purge the memory and return the CellScale to defaults. This menu should be used with caution as all calibrations and setups can be destroyed with a key stroke. Master resets require the proper case of letters M or A. Lower case will be ignored. Calibrated data can be stored prior to initializations and recovered using the Data Backup menu

Main CellScale Menu → (7) System → (3) LED Management

```

***** LED Management *****

(1)   LED COMM1:           Enabled
(2)   LED COMM2:           Enabled
(3)   LED SP1:             Enabled
(4)   LED SP2:             Enabled
(5)   LED SP3:             Enabled
(6)   LED RF:              Enabled
(7)   LED POWER:           Bright
(8)   LED POWER DWELL:     10
(ESC) Exit

```

The LED Management menu allows the user to control the LEDs on the CellScale display panel. These LEDs consume power and thus contribute to reducing battery life. If the CellScale is battery powered, disable any or all the LEDs to reduce power consumption. The Sensor LED cannot be turned off. Selection (8) adjusts the duty cycle of the Power LED. Smaller numbers indicate shorter on time. 50 indicates 50% duty leaving the LED on the longest.

Main CellScale Menu → (7) System → (4) Switch Functions

```

***** Switch Functions *****

(1)   Switch #1 function:   Power
(2)   Switch #1 Channel:    1-1
(3)   Switch #2 function:   Power
(4)   Switch #2 Channel:    1-1
(ESC) Exit

```

The CellScale has two external switches accessible from the power connector. This menu sets up the function of the switches. These switches are intended as auxiliary controls as the CellScale is intended to be controlled by Remote RF Indicators (3750CS, 9750A, 9850), or controlled by host mode software. However, it is often useful to have a power switch or an easy access zero switch. Functions that affect scale readings (such as zero, tare, etc.) must be assigned to a selected channel from the scan list. This is the purpose of menu choices 2 and 4.



Main CellScale Menu → (7) System → (4) Switch Functions → (1) Switch #1 Functions

```
***** Choose Function of Switch #1 *****
```

- (1) Find Slaves
- (2) Next ID
- (3) Power
- (4) Print
- (5) Tare
- (6) Total
- (7) Total Clear
- (8) Total View
- (9) Units
- (a) Zero
- (b) Not Defined
- (ESC) Exit

```
Current function of switch #1 is: Power
```

Main CellScale Menu → (7) System → (5) System Power

```
***** System Power *****
```

- (1) Battery (Type 1): 12V Sealed Lead Acid
- (2) Check battery every: 30 seconds
- (3) Send warning at: 10 % Power Level
- (4) Shutdown at: 1 % Power Level
- (5) Shutdown with: switch only
- (6) Re-start with: switch only
- (7) Auto Shutdown: Disabled
- (8) Shutdown Now!
- (9) Battery Calibration
- (ESC) Exit

```
Current Power Level: 110 %
```

The System Power Menu configures the power supply monitoring firmware and power on and power off features.

- Select the battery type in use. This parameter prevents deep discharge of the 3 battery types most used in CellScale systems: 12V Sealed Lead Acid (also for 12V car batteries), 24V Sealed Lead Acid (and vehicles), 10.7V NiCad battery pack used in some MSI Crane systems, and 'Hardwired' directly powered systems. Selecting Hardwired allows any power source from 9V to 30V. No low power warnings are issued, but voltage falling below 9V will still cause the system to automatically power off.
- The battery is checked periodically. This menu item specifies how often the battery is monitored. *Menu item not shown when in hardwired mode.*

```
Type frequency of battery check in seconds (1-255):
```

- Send Warning At % - Specify how much per cent of battery capacity you wish to warned about. For example, with the MSI standard 12V SLA battery in a system with 1-350Ω load cell, a 10% setting will give about 4 hours of warning before the CellScale cuts off. *Menu item not shown when in hardwired mode.*

```
Type % battery that CellScale sends warnings (1-100):
```

- Shutdown At % - Specify the capacity you wish to shut down the system at. This is defaulted to 1%. To maximize the life of SLA batteries, it is a good idea to increase this significantly, if it is convenient to recharge or replace the battery before maximum operating time is reached. This can increase the life of a SLA battery by 2-3 times. However, Ni-Cad batteries are 'happier' when completely discharged, so 1% is an appropriate setting for Ni-Cads. *Menu item not shown when in hardwired mode.*

Type % battery that CellScale shuts down (1-100):

- 5) Shutdown With - This menu item allows the operator to select the power down parameters. The following sub-menu provides the choices: 1-Switch only. This is the SW1 or SW2 set up as power. 2- adds the keyboard in the terminal interface program. 3- adds the ability for any remote device to send a power down signal, such as a 3750CS or a 9850.

```
***** Power down methods *****
(1)    Switch only
(2)    Switch or keyboard input
(3)    Switch, keyboard or remote RF

Current power down method is:   Switch only
```

- 6) Re-start with - similar to the shutdown menu.

```
***** Power up methods *****
(1)    Switch only
(2)    Switch or keyboard input
(3)    Switch, keyboard or remote RF

Current power up method is:     Switch only
```

- 7) Auto Shutdown - provides timed control of shutdown. You can control the conditions under which Auto Shutdown is reset with the following menu. IF the reset condition is met the auto shutdown timer is reset. For example if Reset on Load is set to Yes, then while the scale is being used above the total threshold the timer is continually reset. However is the scale sits below the threshold for the shutdown time period it will turn off automatically. Use the 1 key to select the time period.

```
***** Auto Shutdown ****
(1)    Auto ShutDown:           Disabled
(2)    Reset on Load:           YES
(3)    Reset on Motion:         YES
(4)    Reset if Devices in Registry: YES
(5)    Reset if Commport 1 Activity: YES
(6)    Reset if Commport 2 Activity: YES
(7)    Reset if switch is pressed: YES
(ESC)  Exit
```

- 8) Shutdown Now! - Pushing 8 will turn off the CellScale. To turn back on requires SW1 or SW2 programmed as a power key is pushed, or power is removed then reapplied.
- 9) Battery Calibration – Performed with a precision voltage source. Input voltage as stated in the menu.

```
***** Battery Calibration *****

          Cut off voltage ADC count setting is: 55
(1)    Battery (Type 2): 24V      Sealed Lead Acid
(2)    Data Backup from ROM
(Y)    Save Current Calibrated Value To ROM.
(ESC)  Exit

          Please Set Calibration Voltage at: 21.60 V
Raw A/D counts: 151
```



Press [1] until the desired power source is shown. Adjust the input voltage to the asked for setting. Then press [Y] to calibrate the battery check digital comparator.

Main CellScale Menu → (8) About

```
***** About *****  
  
Hardware built:      04/26/06 at 09:29:30  
Serial number:      123454321  
  
Software built:     04/12/06 at 16:02:04  
Version number:     5-01
```

The about screen provides information on the software version and design date. Registration provides a serial number and a final assembly date. If this screen says “This hardware has not been registered!” , contact MSI for registration information.

MSI0199 is access code

SECTION 4 – SETTING UP COMMUNICATIONS

COMMPORT 2 - RF MODEM

The CellScale, being a networked RF device, requires proper setup of the communications parameters. As mentioned in the introduction, the CellScale uses a Star topology, with the CellScale as the Master device (in most situations). All other devices in the network are remotes (AKA slaves). Each remote must be on the same network, and also must know the address of the master device.

The basic requirements for setting up a CellScale Network are:

- 1) Determine the Base Network for the system. This is a number from 0-63. This number must be unique within the RF range of the system. If no other independent CellScale systems are in the area, any number can be chosen. Multiple CellScale systems (where each CellScale is a master) must have unique Network Numbers for each CellScale.
- 2) Assign a Source Address to the CellScale. This is a number from 1-254. This address is used by each remote to identify the data source for analog data.
- 3) Set the Power Level. Usually “High” is preferred. Low is used to limit range to smaller areas. “Medium” may be needed to meet MPE requirements when using high-gain antennas.
- 4) Set the Baud Rate of the modem. For systems with several remotes, MSI recommends using the “High” setting to ensure highest data throughput. Master Units should always be set to High. Remote units can be set to a lower baud rate to better balance transmission loads.

These settings are all entered using the Communications menus. The easiest way to understand the setup is to use the “RF and Serial Ports Setup Worksheet”. This worksheet shows all the parameters and allows planning the setup before delving into the menus. RF based CellScales use Comm Port 2 to communicate through the RF Modem.

Filling out the Worksheet for RF Network Setup

- 1) Since Comm Port 2 is dedicated to the RF Modem (in RF Systems), check “RF Modem” for C2 function.
- 2) Decide on a base network (0-63) and write it here. In this example we’ll use network 12.
- 3) Set the Master Src Address (1-254). This is the address all remote units must know. In this example we’ll use 105.
- 4) Check High for the power level.
- 5) As this unit is a Master, select “Fast” for the Baud Rate.
- 6) Since this is to be a standard CellScale Network, we are programming the master so check Master here. The DST (Destination) address is not needed for a master unit.

After filling out the RF portion of the worksheet, we can enter the data into the CellScale via the Terminal Interface Program (TIP).

The image shows a configuration worksheet for 'Comm Port 2'. It includes several sections: 'C2 Function' with 'RF Modem' selected; 'Network' (0-63) and 'SRC Address' (1-254) input fields; 'Power Level' with 'High' selected; 'Baud Rate' with 'Fast' selected; 'MasterSlave' with 'Master' selected; and 'DST Address Slave Only'. Below these are radio button options for 'Host' (Off), 'Standard' (RS-232, RS-485, RS-423), 'Mode' (Duplex, Listen, Talk), 'Data Bits' (7, 8), 'Parity' (None, Even, Odd), and 'Host Type' (MSI, SMA Level 1, SMA Level 2). A 'Baud Rate' table is also present.

Baud Rate	9600	57600	600
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



The CellScale™ features a heavy duty, milled enclosure rated at NEMA 4 IP 65 or NEMA 6 IP 67 with the long range an

Setting the RF Configuration

- 1) Connect a terminal to the CellScale. This can be a computer with virtually any terminal emulation software. Set the terminal program for 9600 baud, 8 bits, no parity, 1 stop bit, and no handshaking.
- 2) Press **[Return]** to bring up the Menu. Once connected, the following screen should appear.

```

----- MSI 9000 - CellScale -----
- (c) 2006 Measurement Systems International -
-----

09:48:32                               4/27/06

(1) Channels/Calibration
(2) Communications
(3) Display
(4) Feature Locks/Passwords
(5) Product IDs
(6) Set Points
(7) System
(8) About...

Enter choice :
```

- 3) Select the Communications menu by typing 2. The following menu will appear.

```

***** Communications Setup *****

(1) Comport 1: Terminal
(2) Comport 2: RF Modem
(3) Comport 3: RF Host
(4) Comport 4: RF Host
(5) Comport 5: RF Host
(6) Data Strings
(7) Registry
(8) Setup KF host commands
(9) Assigned Legal For Trade Control Device: 200
(A) RF Network List
(ESC) Exit
```

- 4) Push 2 to select Comm Port 2. The following menu appears.

```

***** Comport 2 Settings *****

Banner:WIT2450 v2.01 Cirronet, Inc. (c) 2004 :BASE [00 21 25]

(1) Function: RF Modem
(2) Change Network 02
(3) Change Baud Rate Fast
(4) Change Power Level High
(5) Change Master/Slave Master
(6) Change My Address 002
(7) Change Master Address N/A when set as Master
(8) Monitor radio comms
(9) Talk directly to radio
(a) Reset radio to defaults
(b) Alternative Frequency Bands
    [2400.2 - 2474.5]MHz FCC/ETSI operation.(default)
(c) Advanced Radio Setup
(N) APPLY SETTINGS NOW & READ RADIO PARAMETERS!
    Radio Serial Number: 002125
(ESC) Exit
```

- 5) To change the Network number, push 2. The following menu appears.

```
Enter network number (0 - 63):
```

- 6) Enter the desired Network number. For our example, type 12, then press return on the terminal keyboard. Now the Comm 2 Settings menu appears with the network changed to 12.

When configuring multiple CellScale networks, make them consecutive numbers. This actually generates the least interference between networks. For example, network 02 and 03 interfere with each other less than 02 and 61 would. Consecutive numbers have the larger variation in hopping patterns.

- 8) Next change the Baud Rate if needed. In our example we'll change it to "Fast". Push 3 on the terminal. Push 'F' (case indifferent) followed by the return key to change the baud to the Fast mode.

Fast is the preferred data rate. This provides the highest throughput of data. Using slow or medium can reduce power consumption in battery powered units, but should only be used in remote units.

- 9) Adjust the Power Level if needed by pressing the 4 key. Press 'L' for low power mode, 'M' for medium power, or 'H' for high power mode, followed by the return key.

High is the preferred power level. Only use low or medium for very short transmission distances with clear line of site conditions or to reduce power when using high gain antennas.

- 10) Enter the desired Master Source Address by pressing 6 ("Change My Address") and then entering the number in the entry screen. For our example press 105 then the return key. MSI recommends that this number is set to 03 and higher to maximize throughput.

- 11) Press (capital) N to store your comm port settings.

This concludes all the steps necessary to configure the CellScale into its standard operating mode. The conclusion of the example steps should appear in the Commport 2 Settings menu.

```
***** Commport 2 Settings *****

Banner:WIT2450 v2.01 Cirronet, Inc. (c) 2004 :BASE [00 21 25]

(1)  Function:                RF Modem
(2)  Change Network           12
(3)  Change Baud Rate         Fast
(4)  Change Power Level       Medium
(5)  Change Master/Slave      Master
(6)  Change My Address        105
(7)  Change Master Address    N/A when set as Master
(8)  Monitor radio comms
(9)  Talk directly to radio
(a)  Reset radio to defaults
(b)  Alternative Frequency Bands
     [2400.2 - 2474.5]MHz FCC/ETSI operation.(default)
(c)  Advanced Radio Setup
(N)  APPLY SETTINGS NOW & READ RADIO PARAMETERS!
     Radio Serial Number: 002125
(ESC) Exit
```

Menu choices 8 and 9 are provided for troubleshooting and diagnostics. Pressing 8 provides a means to monitor the communications to and from the CellScale. Pressing 9 provides a direct access to the modems processor. This should not be done without intimate knowledge of MSI modem commands. Please contact MSI for information.

Pressing 'a' returns the modem to its defaults. If you do this the modem will be set to network 0, slow baud, high power, remote mode, and src and dst addresses will be 170. This will not operate as a CellScale until, at the very least, you change it into a Master.

Menu choice 'b' is provided to setup the modem to avoid 802.11b networks. If a 802.11b network is operating near the CellScale system, select which band the CellScale should avoid. Contact your network administrator

to determine the 802.11b band in use. Also found here is a setting that makes the 9000 French compliant.

CommPort 2 Menu → (c) Advanced Radio Setup

```

***** Advanced Radio Setup *****

(1) Hop Duration:          10.0 mSec
(2) Max Number of Remotes:      8
(3) Bytes Per Slot:           32
(4) Retry Limit:              8
(5) Lockout Key:              0
(6) Protocol Mode:            7
(7) Access Mode:              2
(8) Network Mode: Link to network 2 only
(ESC) Exit

```

The Advanced Radio Setup is useful for larger networks that may require fine tuning for maximum performance. The default settings should suffice for most scale applications and MSI recommends that you don't change these default settings. ***If the CellScale network needs more than 8 remotes, you must change item 2. Enter the actual number of remotes needed (16 is maximum in a CellScale system).*** There is no user benefit to reducing the number of allowable remotes to less than 8.

When setting up a network, keep in mind that time slot length, maximum packet size, and hop duration are all interrelated. The *hop duration* parameter will determine the time slot size and the maximum amount of data that can be transmitted per hop by the remotes (slaves).

Maximum data length of a remote / hop duration = bytes per second

To determine the precise amount of capacity, you can actually set up the radio system and then query the *maximum data length* from one of the remotes in control mode to discover its exact setting. Divide this number by the *hop duration* as above to get the remote's exact capacity.

Once a parameter has been changed in the base (Master), it is automatically changed in the remotes. The parameters that are automatically changed are *hop duration* and the *duty cycle*.

The amount of data that the Master can transmit per hop is determined by the *base slot size* parameter. The maximum amount of data sent by a Master per hop is 208 bytes.

212 bytes per hop is the maximum data length a remote can transmit per hop, subject to limitations imposed by the *hop duration*, the *base slot size* and the number of registered remotes.

The access mode setting is distributed to all remotes in the base status packet, so changing it at the base affects the entire network. MSI CellScale products are designed to use access mode 2, TDMA auto slots. **Do not change this parameter.**

CONFIGURE A CELLSCALE AS A SLAVE

The only changes necessary are:

- 1) On the Commport 2 Settings Menu, use menu choice [5] to change the device to a remote.
- 2) Input a unique My Address that is not the same as the Master CellScale, using menu choice [6].
(Src Address turns into My Address when the modem is configured as a slave)
- 3) Input the Master CellScales address using Menu choice [7].
(Dst Address turns into Master Address when the modem is configured as a slave)

Be sure all remote (slave) devices are on the same network, have unique addresses (my Address) and that all know the masters Src Address. Preconfigure and calibrate all A/D channels before disconnecting the terminal from the Remote CellScale. See Section 5 - Scan Lists, and Section 7 - Calibration, for additional Remote CellScale information.

COMMPORT 1 - SERIAL I/O

Comm Port 1 functions in two modes: Terminal Mode, the mode in which we are using to setup the CellScales parameters, and Host Mode. Host mode is used to drive scoreboards, printers, or any other serial device, and offers a means to control the CellScale serially from a computer through the use of the "Host Commands."

All CellScale parameters are setup in the terminal mode. Once Comm Port 1 is switched to Host Mode, only the command ;MSI9MSI9 [Return] will return function to the Terminal mode.

Menu in Terminal Mode

```

***** Comport 1 Settings *****

(1)   Function:           Terminal
(2)   Baud rate:         9600
(3)   Standard:         RS-232
(4)   Mode:             Duplex
(5)   Data bits:        8
(6)   Parity:           None
(7)   Protocol/Handshake: None

(N)   APPLY ALL COMPORT SETTINGS NOW!

(ESC) Exit

```

Menu in Host Mode

```

***** Comport 1 Settings *****

(1)   Function:           Host
(2)   Baud rate:         9600
(3)   Standard:         RS-232
(4)   Mode:             Duplex
(5)   Data bits:        8
(6)   Parity:           None
(7)   Type:             MSI
(8)   Protocol/Handshake: None
(b)   Control:          On command
(d)   Interval:         Once
(e)   Motion:           Enabled

(N)   APPLY ALL COMPORT SETTINGS NOW!

(ESC) Exit

```

The settings menu is straightforward.

- 1) Function has three modes: Terminal, Host, and Off. The Terminal mode is needed to operate these menus. The Host mode converts the port to a standard RS-232/485 interface and allows the use of the port with printers, scoreboards, and direct host mode operation. Once the “N” key is pressed the change is made. But until that time the Terminal mode is left on to complete the settings.
- 2) Baud Rates: Standard is 9600. Supports 300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 76800, 115200 and 230400.
- 3) Standard- Two serial standards are supported by the CellScale: RS-232 and RS-485. The RS-485 setting is also compatible with RS-422. The RS-485 setting is full duplex and unterminated. If the CellScale is the final device in a RS-485 network, an external 120 Ω 1/2W termination resistor should be added. 2-Wire simplex operation is possible by tying the transmitter and receiver lines together, keeping polarity intact.
- 4) Mode- The comm port can be set for full duplex, talk only, listen only, or off. Talk only is appropriate for one way devices such as printers or scoreboards. However, if software handshaking is employed, the duplex mode must be selected.
- 5) Data Bits- Choose 7 or 8 data bits. Most modern equipment is set for 8 bits.
- 6) Parity- Select none, odd, or even.
- 7) (Host Mode) Type- Select MSI standard host commands, or SMA level 1 or SMA level 2. See section 10 for details on host commands. If this port is to be used for interfacing to Grayhill I/O modules, select “Grayhill ProMux”.
- 7) (Terminal Mode) - Protocol / Handshake (same as #8 in terminal mode)
- 8) (Host Mode) - Protocol / Handshake. Select various handshaking and protocol modes with this command.
 - 1) Xon/Xoff - standard software handshaking. You must allow for a latency of about 32 characters depend-



ing on comm port speed. 2) DCE. 3) DTE. 4) CTS/RTR. See additional comments on these handshaking modes following.

- b) Control - The control choices are: 1) On command - the CellScale must receive a print command from either a host, or from a key programmed for "Print". 2) On CTS - The CellScale will output data when CTS is asserted. Many printers operate this way, the CTS line is asserted when you push the printers print key. 3) On Weight Change - every time a weight changes, and then settles, data will output. 4) On Load - Follows Total threshold rules. When the weight exceeds the total threshold, one transmission of data strings will occur. The scale must then go below the "fall below" threshold before another transmission can occur. 5) On Set Point Trigger - If included in the set point output list, any set point can trigger a data transmission. 6) On Total - When a total occurs, a data transmission outputs. 7) Continuous Output - Data will output at the rate set by the Interval command.
- d) Interval - Determines the rate the continuous output transmits. Use 0 for a single transmission, enter 100 to 10000 milliseconds (.1 to 10s) in 50ms increments.
Data going out via RF must have an RF transmission rate set up fast enough to keep up. See RF Registry to set RF transmission rate.
- e) Motion - Determines if data transmissions are allowed if the scale is in motion. If driving a scoreboard, motion can and should be disabled. If driving a printer where the weight printout should always be accurate, enable Motion.
- N) Apply all Comm Port Settings Now - This command is provided to allow you to set up Comm 1 as a printer output (for example) and still set it up with the Terminal Interface mode. Once the CellScale receives the "N" command, the terminal interface will quit working. To return to the terminal interface mode will require sending the Terminal Access Mode string ;MSI9MSI9[Return]

Explanation of Handshaking Modes

Xon/Xoff - As buffers approach full status, the receiving device sends to the transmitting device Xoff. The transmitting device must stop transmitting until it receives the Xon command. The latency of this handshaking method requires that buffers are sufficiently large in receiving devices, so the transmitting device can respond in time.

DCE - In DCE mode the CTS line functions as a ENRX line (enable receiver request) and the RTS line functions as an RTR line (ready to receive output from receiver).

VIRTUAL (WIRELESS) COMM PORTS 3-5

The following menu appears for the Virtual Comm Ports 3-5. Description of the menu choices are the same as for Comm1 and Comm2 except the selection numbers have changed.

```

***** Comport 3 RF Host Settings *****

(1)   Type:                MSI
(2)   Control:             On command
(4)   Interval:           Once
(5)   Motion:             Enabled

(N)   APPLY ALL COMPORT SETTINGS NOW!

(ESC) Exit

```

DATA STRINGS

Each Comm Port whether internal or virtual has data strings for use in providing formatted output to connected devices. Each Comm Port has a large data string (up to 512 characters) plus a start and end string (64 characters each). Also strings are generated by the set points, ID Codes, and channel names. All these strings can be called into the main comm port strings using the MSI "@ Codes" (see section 7).

Depending on the application, the strings can vary widely. A string designed to output data to a scoreboard can be quite simple. A string designed to output to a bar code label printer can be very complex. Strings for input into data bases are easily programmed with tab or comma delimiters as required by the data base in use.

All data generated by the CellScale can be retrieved through the use of the MSI "@ Codes". In addition, any ASCII text can be inserted anywhere in the string.

Comm Port String: Up to 512 characters. Due to @ Codes the resultant output can actually be larger than 512 characters.

Comm Port Start String: The “Start” string can be 0 to 64 characters long. It is intended for commonly used commands that usually precede printed lines. Typically ESC codes are used on some printers to enable or format the print string. The start of line string is usually referred to as the “SOL string”. The string defaults to empty.

Comm Port End String: The “End” string can be 0 to 64 characters long. Most commonly used for Carriage Return (CR) or Line Feed (LF), or CR/LF. The EOL string defaults to CR/LF.

INPUTING COMM PORT STRINGS

- 1) From the main menu, select “Communications” [2]. Then press “Data Strings” [6]. The following menu appears. The Data Strings menu provides access to all the comm port strings as well as set point and ID strings.
- 2) Use the [1] key to select the comm port.

Main CellScale Menu → (2) Communications → (6) Data Strings

```

***** Data Strings *****

(1)   Change Commport       : 3
(2)   Commport Start String : -----
(3)   Commport End String   : **-----
(4)   Commport Main String  : @W1@E@W4@E@W3@E@E---

(5)   Change Product ID    : 1
(6)   ID String #1         : -----
(7)   ID String #2         : -----

(8)   Change Set Point     : 1
(9)   Set Point String     : -----
(ESC) Exit

```

- 3) For example, to input an End String with carriage return, line feed, push [3]. The “edit a Data String” screen appears. This is a general purpose data entry screen which is used for all the string entries. The only variation is in the maximum length allowed for each type of string. The edit screen shows the cursor position, and a character and hex readout of the character in the string. This allows instant recognition of characters which do not display such as control and escape characters.

```

***** Edit a Data String *****

(1)   Enter string by typing on keyboard
(2)   Enter Hex-ASCII value
(d)   Initialize to defaults
(ESC) Exit

Pos  Cur   Hex      Comport 3 end string
0    <cr>  0x0D    **-----
                ^

```

- 4) If the string is standard keyboard characters, push [1] to use the keyboard for entry. For non-standard characters, push [2]. Then using an ASCII chart (see appendix) input the special character in HEX data form (0-9 and A-F). Then any data up to 255d (FFh) can be transmitted to the designated comm port.
- 5) After the required string is completed, terminate the string by pushing the [ESC] key.

Designing Print/Data Strings

The CellScale allows any combination of available data to be transmitted via the comm ports and the virtual comm ports. The mechanism for designing the output data strings is the MSI “@ Codes”. These codes are detailed in Section 8. Combine @ codes with any standard text to form truly versatile data outputs.



To Initialize a Print string

- 1) From the main menu, select “Communications” [2]. Then press “Data Strings” [6].
- 2) Use the [1] key to select the comm port.
- 3) Use the numbered key next to the string you wish to initialize.
- 4) When the edit screen appears, push the [d] key. The string will initialize to standard defaults.

Standard Defaults:

Main String - Current Weight CR/LF, Net Weight CR/LF, Tare Weight CR/LF CR/LF
 Start of Line - Blank
 End of Line - CR/LF
 All other strings - Blank

RF REGISTRY

The CellScale employs a registry of connected devices so it can arbitrate the data. There are two basic types of RF devices: 1) A “Smart” device which is a 3750CS or 9850 CellScale Indicator, a CellScale remote, or a 9750A CellScale handheld, and 2) An RF “Host” device, which is any device connected via a 9020 CellModem. This would include scoreboards, remote printers, or computers. A host device can be transmit only, receive only, or bi-directional. Smart devices log on to the network automatically whereas host devices have to be configured using the Registry menus.

The registry controls the speed of data transmission to remote devices and aspects of how devices are remembered. Up to 16 devices are permitted in the registry. These can be any combination of 9020 Modems, 3750CS or 9850 indicators, Remote CellScales, and 9750A Handhelds.

To ensure reliable reconnection of devices, **all potential Remote devices must be registered.** The the Master will remember the device when it reconnects and instantly start providing data.

Main CellScale Menu → (2) Communications → (7) Registry

```

***** Registry *****

(1)   Contact a smart device
(2)   Configure a device
(3)   Add a 9020 CellModem to Comm3
(4)   Add a 9020 CellModem to Comm4
(5)   Add a 9020 CellModem to Comm5
(c)   Contact smart device with serial number & address
(n)   Show next page of devices
(d)   Remove a device
(ESC) Exit

1. Terminal screen  SN# FFFFFFFF address: 255 is Active.
2. Slave CellScale  SN# 002093 address: 10 is NO_TARGET
3. MSI HandHeld    SN# 002098 address: 48 is NO_TARGET
4. Slave CellScale  SN# 001364 address: 93 is .....|
5. No device        SN# 002130 address: 255 is NO_TARGET
6. No device        SN# 000336 address: 255 is NO_TARGET
7. No device        SN# 002140 address: 255 is NO_TARGET
8. No device        SN# FFFFFFFF address: 255 is NO_DEVICE

```

Main CellScale Menu → (2) Communications → (7) Registry → (n) Show next...

```

**** Registry ****

(1)   Contact a smart device
(2)   Configure a device
(3)   Add a 9020 CellModem to Comm3
(4)   Add a 9020 CellModem to Comm4
(5)   Add a 9020 CellModem to Comm5
(c)   Contact smart device with serial number & address
(n)   Show next page of devices
(d)   Remove a device
(ESC) Exit

  9. No device      SN# FFFFFFFF address: 255 is NO_DEVICE
 10. No device      SN# FFFFFFFF address: 255 is NO_DEVICE
 11. No device      SN# FFFFFFFF address: 255 is NO_DEVICE
 12. No device      SN# FFFFFFFF address: 255 is NO_DEVICE
 13. No device      SN# FFFFFFFF address: 255 is NO_DEVICE
 14. No device      SN# FFFFFFFF address: 255 is NO_DEVICE
 15. No device      SN# FFFFFFFF address: 255 is NO_DEVICE
 16. No device      SN# FFFFFFFF address: 255 is NO_DEVICE
    
```

To contact a 9020 modem, first make sure the network numbers match, and you know the address of the 9020 (see 9020 Manual). Then follow these steps:

- 1) From the registry menu, select Comm3, 4 or 5 (virtual comm ports).
- 2) Type in the address of the 9020 Modem. This address is setup directly in the modem (see 9020 Modem Manual for procedure). Push **[Return]**.
- 3) The registry is updated with the new modem location.
- 4) Setup Data Strings as required in the Communications Setup Menu. There can be multiple COM3 (or COM4, or COM5) devices as long as they all can receive the same data. For example, using multiple identical scoreboards could be handled by assigning each to modems on COM5. Remember that each modem must have a unique address in the common network.

Main CellScale Menu → (2) Communications → (7) Registry → (1) Contact a smart device

```

Source address of device to contact:
    
```

This menu is used in conjunction with 3750CS, 9850, and 9750CS Handheld Meters. These are smart devices that use MSI's command protocol to control and communicate with the Master CellScale.

Main CellScale Menu → (2) Communications → (7) Registry → (d) Remove a device

```

Source address of device to remove:
    
```

Smart devices will drop out automatically once they no longer respond to queries. To remove a device configuration, note the registry location and use this menu to remove the configuration. Note that the next time the device logs on to the network, it will revert to defaults. It is best to configure the device and leave the configuration stored unless the device is not to be used again.

Host devices do not drop out automatically and occupy processing time to support. Make sure no unused host device (COM3, COM4, and COM5) is in the registry.



Main CellScale Menu → (8) System → (2) Registry → (2) Configure a device

```

**** Configure Registry ****

(1) Change current device from : 1
(2) Change device name       : 3750CS Meter1
(3) Change broadcast rate    : 1 msgs every 1 secs
(4) Change timeout          : 30 seconds
(5) Change retry             : 10 seconds
(6) Change retry attempts    : 255
(7) Save this device profile
(8) View/Delete device profiles
(ESC) Exit

Messages sent: 10
Messages received: 10
  
```

This menu appears for “Smart Devices” only. Once the device is set up **always save** the device profile by pushing [7]. This ensures the device is remembered and will speed log-on times.

- 1) Use the [1] key to scroll through the existing registry devices
- 2) Use the [2] key to enter a name for each device. Giving each remote device a name to designate its function and/or location is a good way to organize the CellScale network.
- 3) Broadcast rate defaults to 1 transmission per second. This is adequate for most applications. As registry device quantity increases, throughput will go down, especially on devices with this parameter set too high. Limit small networks to 10 transmission per second. Large networks with 4 or more smart devices (3750CS, 9750) should have fewer transmissions per second per device. 3750CS, 9850, and 9750A meters require the most transmission time. Usually modems hooked to devices such as scoreboard displays require little data and therefore do not slow down the network. Limited to a maximum of 10 transmissions per second. The Broadcast rate is only related to weight transmissions on MSI RF Indicators.
- 4) Timeout is how long the CellScale will wait for a remote device to respond, before dropping it from the active registry. Make this number large enough to give you time to turn on the peripheral device.
- 5) Retry is the time delay before the CellScale attempts to contact a lost device.
- 6) Retry attempts is how many times the CellScale attempts to contact a lost device before it gives up.

Special Setup for Master CellScales with Remote CellScales in the registry

In the registry screen for the remote CellScale, set the retry attempts to 255. This will prevent the remote from ever being dropped from the registry. Make sure you save the device profile. Typically a Remote CellScale will be found in spreader bar or multiple hoist applications.

Main CellScale Menu → (8) System → (2) Registry → (3) Configure a device → (8) View/Delete device profiles

```

**** View/Delete a Registry Profile ****

(1) Show the next profile.
(2) Show the previous profile.
(3) Delete this device profile
(4) Delete all device profiles
(ESC) Exit

This is device profile # 1

Device address : 255
Device name    : No device
Broadcast rate : 1 msgs every 1 secs
Timeout       : 30 seconds
Retry         : 10 seconds
Retry attempts : 5
  
```

This menu is used to review and delete registry profiles. When a device is permanently eliminated from the network, be sure to delete its registry or the CellScale will waste time trying to recontact it.

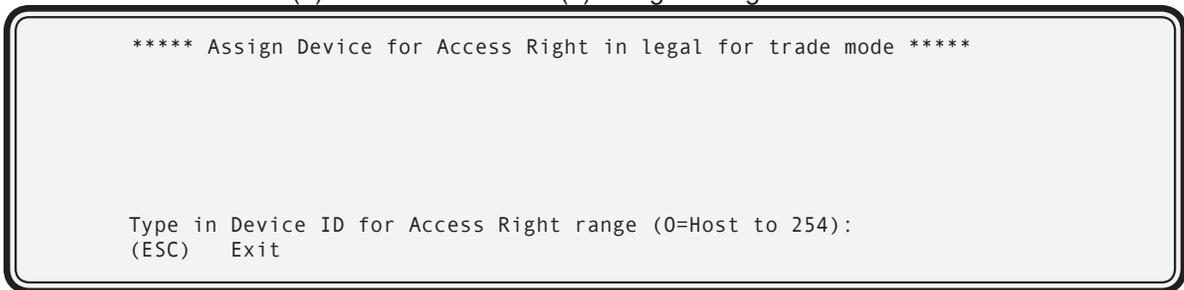
LEGAL FOR TRADE CONTROL DEVICE

When the CellScale is configured for NTEP or OIML Legal-For-Trade (LFT) only one remote device is allowed to have control over the CellScale. The control device is the only RF connected device that can zero, tare, calibrate, and any other controls that are considered metrologically significant. This control can be assigned to a 3750CS Remote Display, a 9750A Handheld Display, or to a 9020 CellModem connected to a computer using the MSI Host commands. 9850 Indicator approval is pending.

Additional RF connected devices are allowed, but they can only function as displays with no controls. Thus you can assign, for example, a 9750A as the control device, but you can still operate a scoreboard display connected to a CellModem (MSI-9020). Additional 9750A's can monitor the weight, but they would not be able to zero or tare the weight, or change the weight mode.

The assigned Control Device RF ID must be known before entering this menu. The number needed is referred to as "My ID" in a 3750CS, or "My address" in the 9750A. These can be read from the Modem settings in each device. Of course, the main Network numbers must match between the CellScale Master device (9000, 6260CS, 9300, 9260, etc.), and the assigned LFT control device.

Main CellScale Menu → (2) Communications → (9) Assigned Legal-For-Trade Control Device



```
***** Assign Device for Access Right in legal for trade mode *****

Type in Device ID for Access Right range (0=Host to 254):
(ESC)  Exit
```

- 1) From the main CellScale Menu, press [2] Communications, then [9] Assigned Legal-For-Trade Control Device.
- 2) Use the numeric keys on your terminal to enter the address of the control device. Legal addresses range from 0 to 254. Use only the "My ID" or "My Address" portion of the designated control device.
- 3) Press ENTER to store the control device address. Press ESC to abort the reassignment of the control device.
- 4) Confirm the correct control address has been assigned.
- 5) Press ESC one or more times to return to other menus.

This menu does not effect non LFT standard settings – Industrial, or Metric.



SECTION 5 – CHANNELS, SCANLISTS, AND PRODUCT ID CODES

The CellScale's multiple channel capability allows a single CellScale to monitor multiple inputs. The mechanism for this is the Scan List. The Scan List is merely a list of input channels, math channels, and or remote channels, that dictate the order in which the CellScale reads its inputs.

Channel Numbering Convention

Channels in the CellScale are organized by A/D input channel number followed by Mux sub channel number. The standard CellScale has 2 A/D inputs, but can be ordered with 4 A/D inputs with the addition of a second A/D Converter module. Each A/D channel can be further divided by the use of external multiplexers into 8 additional inputs per channel, providing a total of up to 32 independent channel inputs. The channels are designated like this:

$$\text{Channel (A/D 1-4)} > \mathbf{1-1} < \text{Sub channel (mux 1-8)}$$

The channel will vary from 1-4 and the sub channel from 1-8. In addition the CellScale provides channel 5 for remote CellScales, and channel 6 for math channels which allow the user to add or subtract channels from each other or perform other math manipulations of the data. All calibration data for the 32 channels is stored in the CellScale.

The CellScale has 6 basic channel types. The channel is designated by two numbers, a channel number (1-6) and a sub-channel number (1-8).

Channel 1 - A/D Input 1. This is the default channel. Data is converted by A/D board 1.

Channel 2 - A/D Input 2. Uses the same A/D as channel 1.

Channel 3 - A/D Input 3. Requires the 2nd A/D option.

Channel 4 - A/D Input 4. Uses the same A/D as channel 3.

Channel 5 - Remote CellScale Input. A remote CellScale provides A/D data for channel 5 which is calibrated in the remote, but otherwise data manipulated in the master CellScale.

Channel 6 - Math Channel. Allows math manipulation of multiple channels.

Each channel also is assigned 8 subchannels. On A/D channels 1-4, these subchannels correspond to connections in the Multiplexer option. For Remote (5-x) and Math Channels (6-x), the subchannels just add additional user programable channels.

It should be noted that subchannels are useful even when the multiplexer option is not used. For example, channel 1-1 could be calibrated as a 1000 x 0.5 kg scale, and channel 1-2 as a 2000 x 1 kg scale, making a dual range platform (of course this assumes the platform is capable of handling 2000 kg). This will work as long as the main channel remains constant. So, 1 platform could be calibrated as 8 independent scales. This works because the CellScale does not know or care if a Multiplexer is actually present. It treats the input as a separate scale. Each "pseudo scale" must be calibrated independently.

The "Scan list" is stored in the CellScale, with up to 32 channels present in the list. Each channel can be active or inactive. When active the CellScale routinely converts the input into data. When inactive, the channel is skipped and no data is taken from it. This feature allows the CellScale to store calibration data on multiple inputs even if those inputs are going to be used irregularly. The first number in the scan list is called the Scan List Index number. The CellScale can have up to 32 Scan List indices. A scan list can include "Math Channels" which provide a means to perform math calculations with data from the input channels. MSI provides a setup form for the channel list which makes it easy to organize multiple channels with multiple calibrations. It is advised that the "Channel List & ID Codes Worksheet" is used to organize your CellScale System. The worksheet provides a framework for all the data contained in the channel list and ID registers.

ID CODES

- The CellScale stores up to 32 ID codes. You can have any combination of ID Codes with Input channels. 1 input channel can have 32 ID codes or 4 input channels could have 8 ID Codes each. Each channel (including math channels) in the scan list is automatically assigned 1 ID Code.
- Each ID Code stores a Tare Value, a Total Value, a weighment counter, display mode (Net, Gross, Peak, etc.), Unit (lb., kg, ton, etc.), and two 20 byte ID code strings. Each product code also computes and stores statistics of Average, Min., Max., Standard Deviation, and Coefficient of Variance.
- ID Codes are created when a new name is entered by the user in a smart device like a 3750CS or the 9750A Handheld. Alternately, ID Codes are entered in the terminal interface mode directly into the

CellScale. The name can be all numbers, all letters, or a combination of numerals and letters. Once the name is entered by the user, the CellScale scans its memory to see if the ID Code already exists. If it does, all new totaled weightings are added to the previously totaled weightings, and any preexisting Tare value will be used for NET weight computation. If the name did not already exist, the CellScale creates a new ID Code.

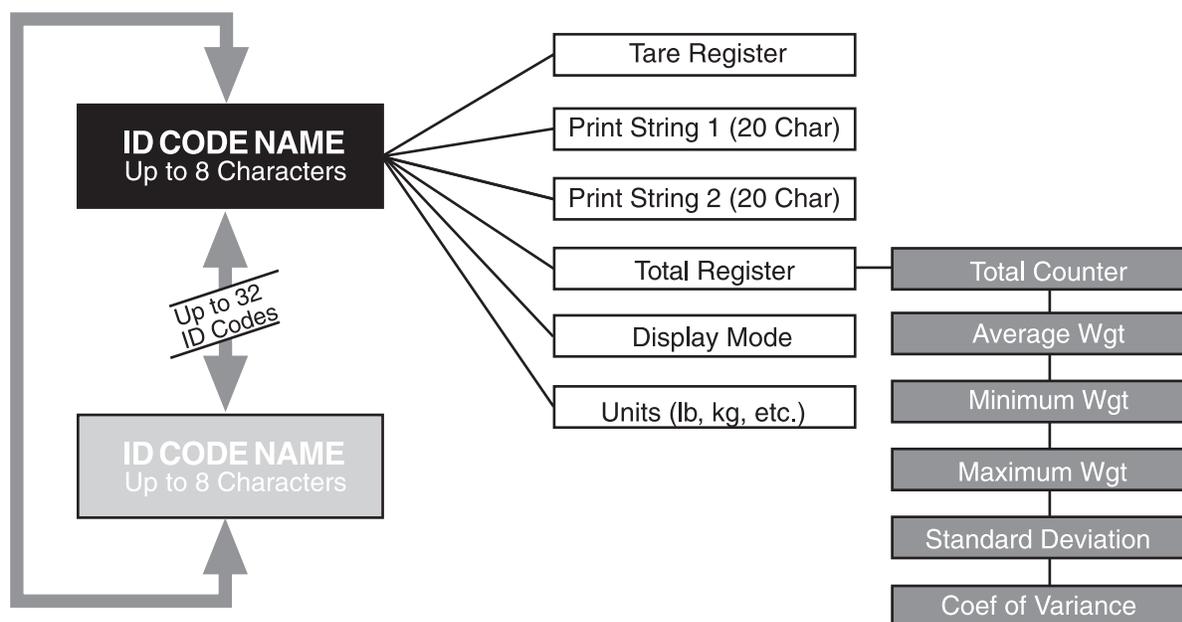


Figure 5 - Product ID Codes Structure

FILLING OUT THE CHANNEL LIST & ID CODES WORKSHEET

Determine how many independent input channels you need. This is dictated by how many physical sensors you have. Each scan list position always has at least 1 ID Code associated with it. If you have multiple products to totalize, you may need multiple product IDs saved with each channel.

- 1) Starting at the left side of the form, put a “1” in the SC# field. This designates scan list position 1.
- 2) Input the channel and sub-channel number in the Channel # field. This is the actual input channel used. Use 1-1 to 1-8 or 2-1 to 2-8 for A/D inputs in the standard configuration. Use 3-1 to 3-8 or 4-1 to 4-8 for inputs found on the optional second A/D module. Use 5-1 to 5-8 for remote CellScale inputs, and 6-1 to 6-8 for Math channels.
- 3) Optional - Input a name for the channel in the Channel name field. Up to 20 characters can be used. If the name is to be displayed on the 3750CS limit the name to 8 characters. Example names; Platform 1, Hoist 2, Scale A, etc.
- 4) Input the capacity and count-by (d) of the scale. This step is ignored for math channels.
- 5) Optional - Channel Type. This field corresponds to the preset resolutions as set up in the channel profile menu: Scale Type a - up to 10k counts. This is the standard setting for strain gaged based scales. Scale Type b - up to 1000 counts. This is used for in-motion scales and other specialized scales used in relatively low resolution applications. Scale Type c - up to 50,000 counts. Used on high accuracy or high resolution scale systems. Scale Type d - up to 100,000. Used on multi-load cell high accuracy truck scales. Scale Type 3 - up to 250,000 counts. This represents the highest external resolution allowed. Future implementations will include other data types for temperature and other transducers.
- 6) Optional - Zero Offset. If the scale must return to a number other than zero when “Zeroed”, input the value here. This is used for safety applications where the weight of the scale must be included and also for offset calibration of a partially filled container.
- 7) Product ID - Each input channel is automatically assigned 1 Product ID Code. Use this section of the form to input the three strings associated with each ID Code, the ID Name (20 Char.), ID String 1 and ID String

2 (each 20 characters). These strings are used in identifying and printing setups. If a permanent tare is associated with the ID input the value and check the “NET” button.

- 8) If more ID Codes are needed for this input channel, input the information in the Product IDs section. Leave the Channel section blank.
- 9) Repeat the process for all other input and math channels. When completed the Channel List Worksheet is a reference for entering data into the CellScale.

SETTING UP THE SCAN LIST

The CellScale defaults to a single entry scan list consisting of Channel 1-1. Before you can calibrate or control any function on additional channels they must be added to the scan list. Setting up the scan list consists of using the terminal interface mode and the Scan List functions menu.

Setting up a scan list is made far easier if you are organized with a filled out Channel List Worksheet.

- 1) Select “Channels/Calibration” from the main terminal interface menu by pressing **[1]**.
- 2) Select “Scan List Functions” **[4]**. The following menu appears.

```

***** Channel ScanList *****

(1)   Add a specific channel-subchannel
(2)   Delete a scanList entry
(3)   Edit a scanList entry
(4)   Move a scanList entry
(ESC) Exit
-----

Position = ch-subch, * indicates channel is active

  1 = 1-1 *      9 = ---      17 = ---      25 = ---
  2 = ---       10 = ---      18 = ---      26 = ---
  3 = ---       11 = ---      19 = ---      27 = ---
  4 = ---       12 = ---      20 = ---      28 = ---
  5 = ---       13 = ---      21 = ---      29 = ---
  6 = ---       14 = ---      22 = ---      30 = ---
  7 = ---       15 = ---      23 = ---      31 = ---
  8 = ---       16 = ---      24 = ---      32 = ---
    
```

- 3) The bottom portion of the Channel Scanlist menu is the listing of the current scan list. To add a channel push **[1]**. The next screen prompts for a channel and subchannel number. You must include a subchannel number separated by a hyphen (-) character. For this example, we’ll add channel 2-1. Type 2-1 **[Return]**.

```

Valid primary channels are 1 - 2,
Valid secondary channels are 3 - 4, (2nd A/D option required)
Valid slave channel is 5, (Slave CellScale required)
Valid math channel is 6,
Valid sub-channels are 1 - 8,

Type channel#-subChannel# (Ex. 1-1): 2-1

Position = ch-subch, * indicates channel is active

  1 = 1-1 *      9 = ---      17 = ---      25 = ---
  2 = ---       10 = ---      18 = ---      26 = ---
  3 = ---       11 = ---      19 = ---      27 = ---
  4 = ---       12 = ---      20 = ---      28 = ---
  5 = ---       13 = ---      21 = ---      29 = ---
  6 = ---       14 = ---      22 = ---      30 = ---
  7 = ---       15 = ---      23 = ---      31 = ---
  8 = ---       16 = ---      24 = ---      32 = ---
    
```

- 4) Next the CellScale prompts for the scan list position to place the new channel in. This can be any number from 1-32. In this example we’ll place the new channel in position 2 by typing **[2]** **[Return]**.



```

Valid primary channels are 1 - 2,
Valid secondary channels are 3 - 4, (2nd A/D option required)
Valid slave channel is 5, (Slave CellScale required)
Valid math channel is 6,
Valid sub-channels are 1 - 8,

Type channel#-subChannel# (Ex. 1-1): 2-1

Type the scanList position to place this (1 - 32):2

Position = ch-subch, * indicates channel is active

  1 = 1-1 *      9 = ---      17 = ---      25 = ---
  2 = ---        10 = ---      18 = ---      26 = ---
  3 = ---        11 = ---      19 = ---      27 = ---
  4 = ---        12 = ---      20 = ---      28 = ---
  5 = ---        13 = ---      21 = ---      29 = ---
  6 = ---        14 = ---      22 = ---      30 = ---
  7 = ---        15 = ---      23 = ---      31 = ---
  8 = ---        16 = ---      24 = ---      32 = ---
    
```

5) The Channel ScanList menu now shows the new added channel. Repeat steps 1-4 to add as many channels as needed. See the following section for additional information on adding math channels.

```

***** Channel ScanList *****

(1) Add a specific channel-subchannel
(2) Delete a scanList entry
(3) Edit a scanList entry
(4) Move a scanList entry
(ESC) Exit
-----

Position = ch-subch, * indicates channel is active

  1 = 1-1 *      9 = ---      17 = ---      25 = ---
  2 = 2-1 *      10 = ---      18 = ---      26 = ---
  3 = ---        11 = ---      19 = ---      27 = ---
  4 = ---        12 = ---      20 = ---      28 = ---
  5 = ---        13 = ---      21 = ---      29 = ---
  6 = ---        14 = ---      22 = ---      30 = ---
  7 = ---        15 = ---      23 = ---      31 = ---
  8 = ---        16 = ---      24 = ---      32 = ---
    
```

When adding input channels, the screen may display an overload or underload message briefly. This will happen when a channel isn't calibrated. Just ignore the warnings and when finished entering all channels into the scan list.

6) Input channels default to type a systems which are scales with up to 10000 counts. To raise or lower maximum resolution (determined precisely in the calibration routine) use the "Edit a ScanList entry" menu by pressing [3].

```

***** Edit a ScanList entry *****

(1)   ScanList entry:           01 = Channel 1-1
(2)   Channel 1-1 name:         .....
(3)   Channel type:             Type A, 10,000 counts
(4)   Hardware excitation:      AC
(5)   Hardware output rate:     57 Hz
(6)   # readings per dwell:     16
(7)   Active/in-active status:  Active
(ESC) Exit

Calibrated          YES
Calibration Capacity: 5000
Calibration Countby: 0.5
Calibration Units:  Pounds
Calibration Date-Time: 04/03/06-12:12:29
Current Raw Data:   1531565
    
```

7) First select the ScanList position you wish to modify using repeated presses of the [1] key. Once the desired channel is shown, press the [3] key.

```

***** Set a Channel Type *****

(1)   Scale Type A, Up to 10,000 counts allowed
(2)   Scale Type B, Up to 1,000 counts allowed
(3)   Scale Type C, Up to 50,000 counts allowed
(4)   Scale Type D, Up to 100,000 counts allowed
(5)   Scale Type E, Up to 250,000 counts allowed

Ch 1-1 is currently type A.
    
```

8) Select the desired resolution by pushing the related number key. For example, pushing [4] yields the following screen.

```

***** Set a Channel Type *****

(1)   Scale Type A, Up to 10,000 counts allowed
(2)   Scale Type B, Up to 1,000 counts allowed
(3)   Scale Type C, Up to 50,000 counts allowed
(4)   Scale Type D, Up to 100,000 counts allowed
(5)   Scale Type E, Up to 250,000 counts allowed

Ch 1-1 is currently type D.
    
```

9) Push [ESC] once the desired channel type is displayed. You are returned to the “Edit a ScanList entry” menu.

```

***** Edit a ScanList entry *****

(1)   ScanList entry:           01 = Channel 1-1
(2)   Channel 1-1 name:         .....
(3)   Channel type:             Type D, 100,000 counts
(4)   Hardware excitation:      AC
(5)   Hardware output rate:     57 Hz
(6)   # readings per dwell:     16
(7)   Active/in-active status:  Active
(ESC) Exit

Calibrated          YES
Calibration Capacity: 5000
Calibration Countby: 0.5
Calibration Units:  Pounds
Calibration Date-Time: 04/03/06-12:12:29
Current Raw Data:   1531565
    
```



- 10) If a channel name is needed add one by pressing [2].

Enter new name (up to 20 chars):

- 11) Type in a channel name. Limit the name to 20 characters or less. Note only the first 8 characters are displayed on a 3750CS. Terminate the name entry by pressing [Return].

MSI recommends giving each channel a unique name. The name is used in print strings and on the meter displays to identify which scale you are reading.

- 12) Hardware Excitation: Use [5] to change between AC and DC excitation. MSI recommends AC excitation for most applications due to its superior drift specifications and greatly improved immunity to thermocouple effects.
- 13) Hardware Output Rate: Three rates are provided, 57 Hz, the slowest rate, allows highest accuracy and lowest noise. 135 Hz more than twice as fast, should be limited to 10,000 'd' scales and below. 275 Hz for high speed applications, limit to 5,000 'd' and below. Use the [5] key to select the desired rate. These rates represent a good compromise between speed and resolution. Depending on the system load, these rates don't necessarily reflect the throughput of the CellScale System, which is highly dependent on the network settings.
- 14) # Readings per Dwell: The number of readings the CellScale will dwell on each channel before switching to the next channel in the scan list. This can be used to speed multiplexer throughput if required. The lower the number (Down to 1) the faster the CellScale switches the multiplexer channel. Use the [6] key to bring up the entry screen. The default value of 16 provides stable readings at all resolutions.

Enter # samples to average before channel switch (1-255) :

- 15) Active/in-active status: A channel must be active in order to be calibrated and/or read by any CellScale peripheral. Be sure any channel you wish to read on a continuous basis is active. Since converting any channel takes a finite time, making a channel in-active can speed up the execution of the scan list. When in-active, an input channel retains all its calibration and setup data, but it is skipped in the scan list. Use the [7] key to toggle the active/in-active status.

When dealing with large channel lists, it is often the case that only one channel is of interest at any given time. By making all channels in=active except the one of interest, the conversion rate for the one channel is greatly increased. The CellScale does not convert all the other channels.

CELLSCALE THROUGHPUT CONSIDERATIONS

Speed of the CellScale System is limited mostly by the loop processing time. This time averages about 25ms and thus data cannot be processed at faster than about 40 times a second. This sets the minimum response time to set points and updating data to external devices. RF connected devices are updated at a maximum rate of 10 times per second (set in the registry menu) and therefore RF connected devices have a latency of up to 100ms. In multichannel systems, the timings can be set for maximum throughput by making sure that all converted channels (do not include math channels) are completely converted at least once per 25ms. For example: Running 8 channels at 57 hz means that each channel is being read at about 7 times per second (7.125). This is usually adequate for most applications. However, to maximize response times, the medium A/D rate of 125Hz would allow each channel to perform at a 15.6 readings per second rate. The dwell time and software filters all have an effect on response and settling times. These parameters must be balanced to achieve the desired results in speed and stability. It is advised to calibrate the channels in the lowest usable resolution (larger scale increment 'd') if speed is important. Settling time and apparent noise are highly dependent on resolution.

RF throughput also comes into play when there are a large number of remote devices for the CellScale to service. If this is the case, be sure the baud rate on the modem communications is set to high, and that each registered device is programmed to receive data only as fast as it needs. For example, there is no need to send data to a scoreboard faster than 2 times a second, as that is about as fast as a human can comprehend changing numbers. However, a remote device that is logging data from multiple channels will probably need the 10 transmissions a second to keep up.

There is no one setup that will work for all circumstances. Contact CellScale support for help in making the right decisions regarding throughput, both at the channel level, and RF level.

SETTING UP SLAVE CELLSCALES AS CHANNEL 5

A CellScale configured as a network remote can supply data to another master CellScale via RF using channel 5-1 through 5-8. Setup of this is straightforward. It is advised that the scan list on the remote CellScale is known and documented, and that all channels on the remote CellScale are already calibrated (calibration performed while in the Master mode or connected with a terminal directly to the Remote CellScale). The remote address of the remote CellScale must also be known before starting this procedure.

- 1) Select “Channels/Calibration” from the main terminal interface menu by pressing [1].
- 2) Select “Scan List Functions” [5]. The following menu appears.

```

***** Channel ScanList *****

(1)   Add a specific channel-subchannel
(2)   Delete a scanList entry
(3)   Edit  a scanList entry
(4)   Move  a scanList entry
(ESC) Exit
-----
Position = ch-subch, * indicates channel is active

  1 = 1-1 *      9 = ---      17 = ---      25 = ---
  2 = ---        10 = ---     18 = ---     26 = ---
  3 = ---        11 = ---     19 = ---     27 = ---
  4 = ---        12 = ---     20 = ---     28 = ---
  5 = ---        13 = ---     21 = ---     29 = ---
  6 = ---        14 = ---     22 = ---     30 = ---
  7 = ---        15 = ---     23 = ---     31 = ---
  8 = ---        16 = ---     24 = ---     32 = ---
    
```

- 3) The bottom portion of the Channel Scanlist menu is the listing of the current scan list. To add a channel push [1]. The next screen prompts for a channel and subchannel number. You must include a subchannel number separated by a hyphen (-) character. For this example, we'll add remote CellScale channel 5-1. Type [5][-][1] [Return].

```

Valid primary channels are 1 - 2,
Valid secondary channels are 3 - 4, (2nd A/D option required)
Valid slave channel is 5, (Slave CellScale required)
Valid math channel is 6,
Valid sub-channels are 1 - 8,

Type channel#-subChannel# (Ex. 1-1): 5-1

Position = ch-subch, * indicates channel is active

  1 = 1-1 *      9 = ---      17 = ---      25 = ---
  2 = ---        10 = ---     18 = ---     26 = ---
  3 = ---        11 = ---     19 = ---     27 = ---
  4 = ---        12 = ---     20 = ---     28 = ---
  5 = ---        13 = ---     21 = ---     29 = ---
  6 = ---        14 = ---     22 = ---     30 = ---
  7 = ---        15 = ---     23 = ---     31 = ---
  8 = ---        16 = ---     24 = ---     32 = ---
    
```

- 4) Next the CellScale prompts for the radio address ID of the remote CellScale. This is not the network number. The network numbers have to match already. In this example the remote address of the remote CellScale is 122.



```
Valid primary channels are 1 - 2,
Valid secondary channels are 3 - 4, (2nd A/D option required)
Valid slave channel is 5, (Slave CellScale required)
Valid math channel is 6,
Valid sub-channels are 1 - 8,
```

```
Type channel#-subChannel# (Ex. 1-1): 5-1
```

```
Type the slave CellScale radio ID (1 - 254): 122
```

```
Position = ch-subch, * indicates channel is active
```

```
 1 = 1-1 *      9 = ---      17 = ---      25 = ---
 2 = ---        10 = ---      18 = ---      26 = ---
 3 = ---        11 = ---      19 = ---      27 = ---
 4 = ---        12 = ---      20 = ---      28 = ---
 5 = ---        13 = ---      21 = ---      29 = ---
 6 = ---        14 = ---      22 = ---      30 = ---
 7 = ---        15 = ---      23 = ---      31 = ---
 8 = ---        16 = ---      24 = ---      32 = ---
```

- 5) Next the CellScale prompts for the scan list position of the desired input channel in the remote CellScale. You must know the scan list position. In most situations this will be '1'. The range is 1-32. A calibrated and setup channel must exist in the remote CellScale at the Scan List index number entered here.

```
Valid primary channels are 1 - 2,
Valid secondary channels are 3 - 4, (2nd A/D option required)
Valid slave channel is 5, (Slave CellScale required)
Valid math channel is 6,
Valid sub-channels are 1 - 8,
```

```
Type channel#-subChannel# (Ex. 1-1): 5-1
```

```
Type the slave CellScale radio ID (1 - 254): 122
```

```
Type the slave CellScale ScanList position (1 - 32):
```

```
Position = ch-subch, * indicates channel is active
```

```
 1 = 1-1 *      9 = ---      17 = ---      25 = ---
 2 = ---        10 = ---      18 = ---      26 = ---
 3 = ---        11 = ---      19 = ---      27 = ---
 4 = ---        12 = ---      20 = ---      28 = ---
 5 = ---        13 = ---      21 = ---      29 = ---
 6 = ---        14 = ---      22 = ---      30 = ---
 7 = ---        15 = ---      23 = ---      31 = ---
 8 = ---        16 = ---      24 = ---      32 = ---
```

After entering the (remote) scan list position, the Master CellScale tries to make contact with the Remote CellScale. If it cannot locate the remote, a warning screen will let you know. If this happens check for proper communications setups. The Networks must match, the remote CellScale must have a unique address (my address), and the remote CellScale must have the address of the Master CellScale properly entered.

- 6) Next the CellScale prompts for the scan list position to place the new channel in. This can be any number from 1-32. In this example we'll place the new channel in position 2 by typing **[2] [Return]**.

Type the scanList position to place this (1 - 32): 2

Position = ch-subch, * indicates channel is active

1 = 1-1	9 = ---	17 = ---	25 = ---
2 = ---	10 = ---	18 = ---	26 = ---
3 = ---	11 = ---	19 = ---	27 = ---
4 = ---	12 = ---	20 = ---	28 = ---
5 = ---	13 = ---	21 = ---	29 = ---
6 = ---	14 = ---	22 = ---	30 = ---
7 = ---	15 = ---	23 = ---	31 = ---
8 = ---	16 = ---	24 = ---	32 = ---

- 7) The Channel ScanList menu now shows the new added channel. Repeat steps 1-6 to add as many remote channels as needed. These can be all from 1 additional Remote CellScale or multiple Remote CellScales. See the following section for additional information on adding math channels.

***** Channel ScanList *****

- (1) Add a specific channel-subchannel
 - (2) Delete a scanList entry
 - (3) Edit a scanList entry
 - (4) Move a scanList entry
 - (ESC) Exit
-

Position = ch-subch, * indicates channel is active

1 = 1-1 *	9 = ---	17 = ---	25 = ---
2 = 5-1 *	10 = ---	18 = ---	26 = ---
3 = ---	11 = ---	19 = ---	27 = ---
4 = ---	12 = ---	20 = ---	28 = ---
5 = ---	13 = ---	21 = ---	29 = ---
6 = ---	14 = ---	22 = ---	30 = ---
7 = ---	15 = ---	23 = ---	31 = ---
8 = ---	16 = ---	24 = ---	32 = ---

SETTING UP MATH CHANNELS

The CellScale can perform math operations on any combination of the input channels. Supported math functions are add, subtract, multiply, divide, square root and absolute value. In addition multiple parenthetical levels are supported. Numbers entered in the equations are interpreted as scan list positions and therefore must be from 1 to 32. Constants are indicated by preceding them with the letter 'k'. Up to 8 math channels are possible, defined as channel 6 with subchannels 1-8.

The math channels are perfectly suited for adding individual load cell readings together to form a digitally summed platform scale. Ratios, and balances are also easily calculated. RMS (root mean square) calculations useful in vector addition are possible using the square root function.

Math channels behave like other channels in that you can apply set points to them, print, display, etc.

Before a math channel is programmed, you should have your scale channels determined and entered into the scan list. It is the scan list position that the math channel uses for variable data. For example, scan list position 1 is defined as channel 1-1, position 2 as channel 1-2, position 3 as channel 1-3 and position 4 as channel 1-4. Then a formula that would add all the inputs together would simply be (1+2+3+4). This math formula would assume position 5 in the scan list.

Other formula examples:

11-2|Absolute value of scan list position 1 minus position 2. A formula used to determine the magnitude of imbalance between two scales.

1/2 Ratio of scan list position 1 to position 2.

1+2 Sum of positions 1 and 2.

(1+2)/(3+4) Ratio of position 1+2 to 3+4



$r((1*1)+(2*2))$ RMS (square root of the sum of the squares) of channel 1 and 2.

It is possible to include a math channel in another math channels calculation. However, you must not allow a circular argument.

Math Channel Entry Procedure

- 1) After setting up all the input channels in the scan list, add math channels in the same way as standard input channels except input 6-1 to 6-8 as the channel-subchannel number. Channel inputs are performed in the Channel ScanList menu (Main menu to Channel/Calibration to Channel Scanlist function).
- 3) Once the Math Channel is in the scan list, you add the formula by using the edit functions. In the following screen, there are two input channels and a third math channel.

```

***** Channel ScanList *****

(1)   Add a specific channel-subchannel
(2)   Delete a scanList entry
(3)   Edit a scanList entry
(4)   Move a scanList entry
(ESC) Exit
-----
Position = ch-subch, * indicates channel is active

  1 = 1-1 *      9 = ---      17 = ---      25 = ---
  2 = 1-2 *     10 = ---      18 = ---      26 = ---
  3 = 6-1 *     11 = ---      19 = ---      27 = ---
  4 = ---       12 = ---      20 = ---      28 = ---
  5 = ---       13 = ---      21 = ---      29 = ---
  6 = ---       14 = ---      22 = ---      30 = ---
  7 = ---       15 = ---      23 = ---      31 = ---
  8 = ---       16 = ---      24 = ---      32 = ---

```

- 4) To add the formula to the math channel push 3 “Edit a scanList entry”.

```

***** Edit a ScanList entry *****

(1)   ScanList entry:           01 = Channel 1-1
(2)   Channel 1-1 name:         .....
(3)   Channel type:             Type A, 10,000 counts
(4)   Hardware excitation:      AC
(5)   Hardware output rate:     57 Hz
(6)   # readings per dwell:     16
(7)   Active/in-active status:  Active
(ESC) Exit

Calibrated           YES
Calibration Capacity: 5000
Calibration County:  0.5
Calibration Units:   Pounds
Calibration Date-Time: 04/03/06-12:12:29
Current Raw Data:    1531565

```

- 5) Press the [1] key until the proper math channel appears on line (1).

```

***** Edit a ScanList entry *****

(1)   ScanList entry:           03 = Math 6-1
(2)   Math channel 6-1 name:    .....
(3)   Math channel expression:  (          )
(4)   Active/in-active status:  Active
(ESC) Exit

```

- 6) Press the [3] key to input the math expression.

```

***** Edit a Math Channel Expression *****

(1)   Enter expression by typing on keyboard
(s)   Set expression to sum of all active channels
(d)   Clear the expression
(ESC) Exit

Pos  Cur   Hex      Math channel 6-1 expression
0    0x20  (          )
                ^
    
```

7) Press [1] to input the expression using the terminal keyboard.

```

***** Type a Math Channel Expression *****

(ESC) Exit

Pos  Cur   Hex      Math channel 6-1 expression
0    0x20  (          )
                ^

Type the math expression data:
    
```

8) Using the scan list form, enter channels by their scan list position. Legal operators are: + (addition), - (subtraction), *(multiplication), / (division), r (square root), l xxx l (absolute value, with xxx being an expression or channel, and () to enclose subequations. If the space allowed is not enough you can combine math channels. For this example, we'll add scan position 1 to position 2. If the formula needs constants, add the letter 'k' in front of the constant.

The apparent resolution of a math channel will default to the resolution of the most sensitive analog input channel.

```

***** Type a Math Channel Expression *****

(ESC) Exit

Pos  Cur   Hex      Math channel 6-1 expression
0    0x20  (1+2      )
                ^

Type the math expression data:
    
```

9) Terminate the formula with an [ESC] key (not return). If you get an error message, check the formula for unclosed parentheses, scan channels that don't exist, or common math errors.

Example Scan List for 4 pad truck Scale Application

1 = 1-1 *	9 = ---	17 = ---	25 = ---
2 = 1-2 *	10 = ---	18 = ---	26 = ---
3 = 1-3 *	11 = ---	19 = ---	27 = ---
4 = 1-4 *	12 = ---	20 = ---	28 = ---
5 = 6-1 *	13 = ---	21 = ---	29 = ---
6 = 6-2 *	14 = ---	22 = ---	30 = ---
7 = 6-2 *	15 = ---	23 = ---	31 = ---
8 = ---	16 = ---	24 = ---	32 = ---

- 1= 1-1 *Pad placed under front left wheel*
- 2= 1-2 *Pad placed under front right wheel*



3= 1-3	<i>Pad placed under rear left wheel</i>
4= 1-4	<i>Pad placed under rear right wheel</i>
5= 6-1	<i>Channel 6-1 defined as (CH1-1)+(CH1-2) (see Math Channels)</i>
6= 6-2	<i>Channel 6-2 defined as (CH1-3)+(CH1-4)</i>
7= 6-3	<i>Channel 6-3 defined as (CH1-1)+(CH1-2)+(CH1-3)+(CH1-4)</i>

This scan list could be used with a wheel weighing system. The first 4 channels are connected through a CellScale Multiplexer and provide individual wheel loads. Index position 5 shows front axle load, index 6 shows rear axle load, and index 7 shows total truck weight. The CellScale allows the user to name each channel and the name can appear on the message (lower) display of the 3750CS. When dealing with multiple channels it is recommended that you program the lower display mode to either display the scale channel number (LC NUMBR), the Scan List Index number (SC INDEX), or the channel name (LC NAME).

Example Scan List for an all digital Platform Scale (using dual A/D modules, not a multiplexer)

1 = 1-1	9 = ---	17 = ---	25 = ---
2 = 2-1	10 = ---	18 = ---	26 = ---
3 = 3-1	11 = ---	19 = ---	27 = ---
4 = 4-1	12 = ---	20 = ---	28 = ---
5 = 6-1	13 = ---	21 = ---	29 = ---
6 = 6-2	14 = ---	22 = ---	30 = ---
7 = 6-3	15 = ---	23 = ---	31 = ---
8 = ---	16 = ---	24 = ---	32 = ---

1= 1-1	<i>Left Front Load Cell</i>
2= 2-1	<i>Right Front Load Cell</i>
3= 3-1	<i>Left Rear Load Cell</i>
4= 4-1	<i>Right Rear Load Cell</i>
5= 6-1	<i>TOTAL WEIGHT Channel 6-1 defined as (1+2+3+4)</i>
6= 6-2	<i>Front to rear balance 6-2 defined as (1+2-3-4) (optional)</i>
7= 6-3	<i>Left to right balance 6-3 defined as (1+3-2-4) (optional)</i>

Example Scan List for the all digital Platform Based Truck Scale (uses standard CellScale and 1 9008 multiplexer)

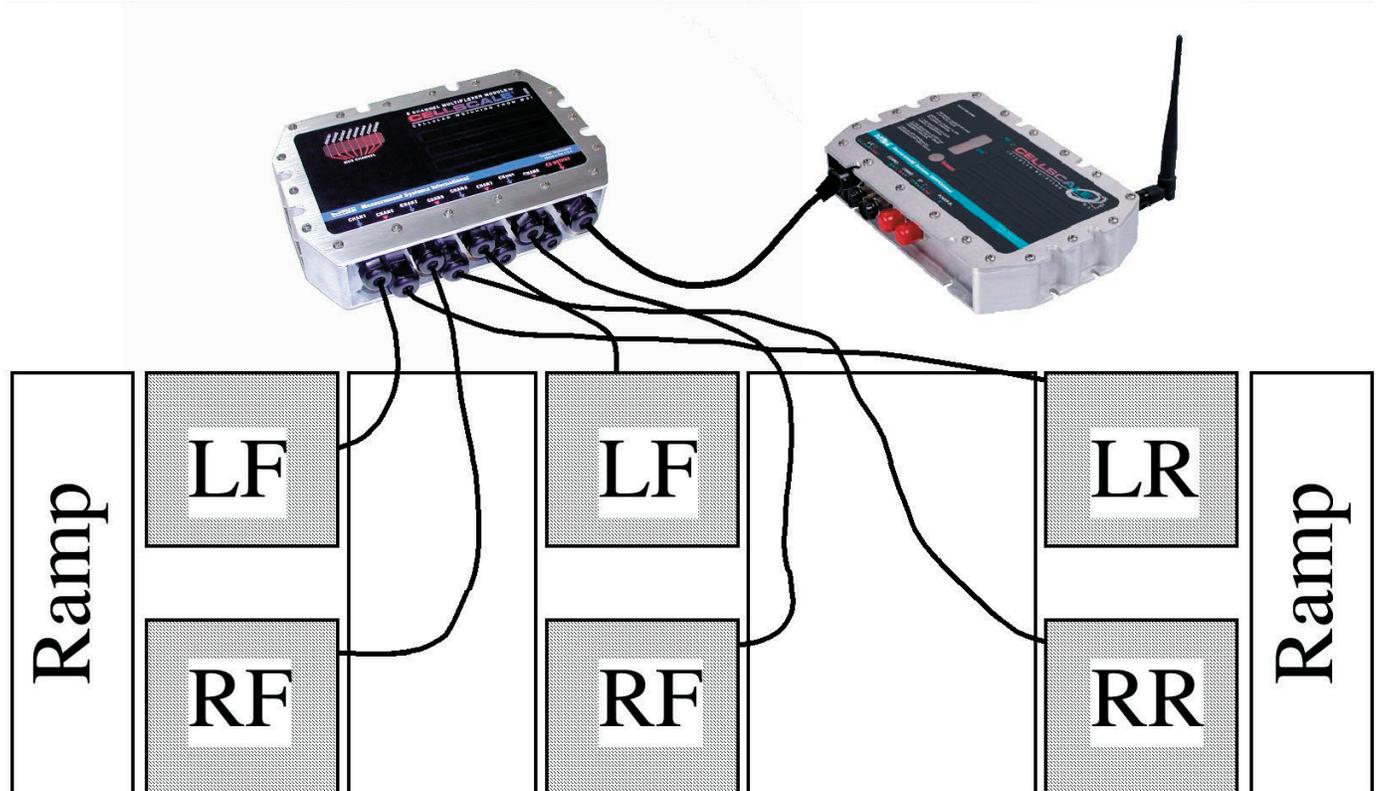
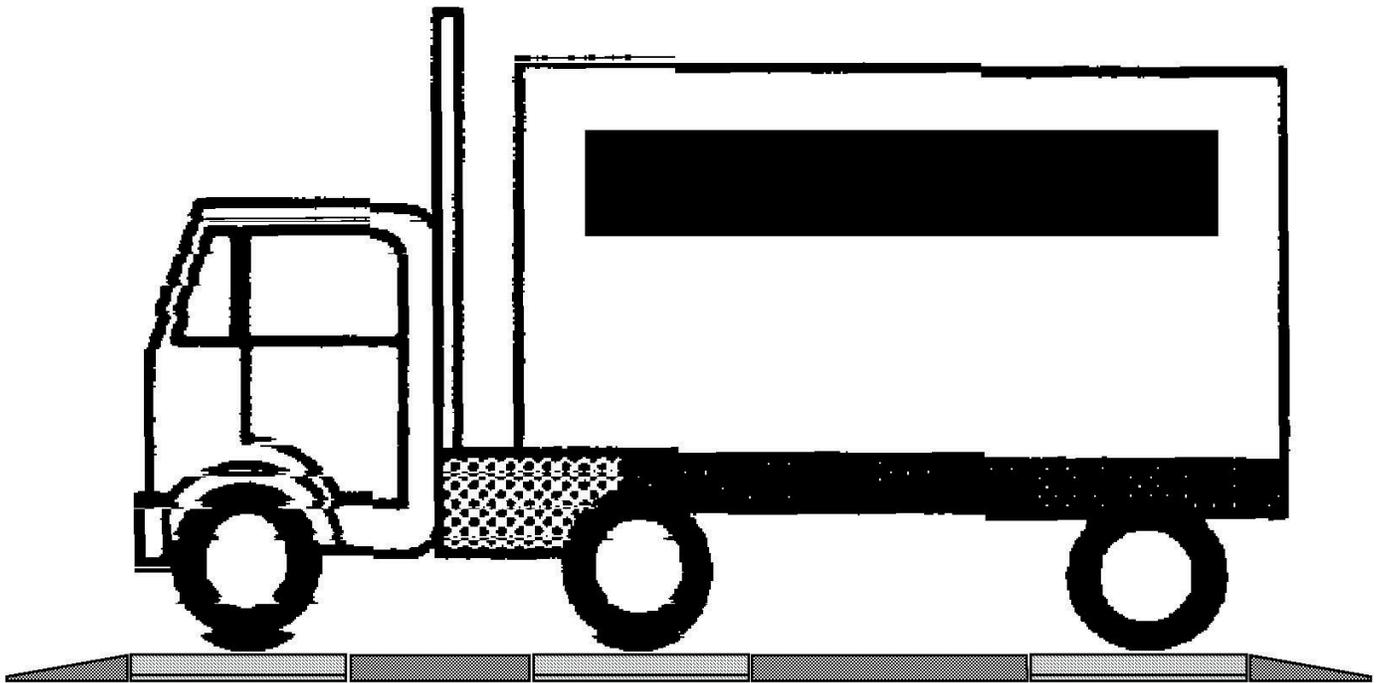
1 = 1-1	9 = 6-3	17 = ---	25 = ---
2 = 1-2	10 = 6-4	18 = ---	26 = ---
3 = 1-3	11 = 6-5	19 = ---	27 = ---
4 = 1-4	12 = ---	20 = ---	28 = ---
5 = 1-5	13 = ---	21 = ---	29 = ---
6 = 1-6	14 = ---	22 = ---	30 = ---
7 = 6-1	15 = ---	23 = ---	31 = ---
8 = 6-2	16 = ---	24 = ---	32 = ---

1= 1-1	<i>Left Front Truck Axle Platform</i>
2= 1-2	<i>Right Front Truck Axle Platform</i>
3= 1-3	<i>Left Front Trailer Axle Platform</i>
4= 1-4	<i>Right Front Trailer Axle Platform</i>
5= 1-5	<i>Left Rear Trailer Axle Platform</i>
6= 1-6	<i>Right Rear Trailer Axle Platform</i>
7= 6-1	<i>Truck Axle Total 6-1 defined as (1+2)</i>
8= 6-2	<i>Front Trailer Axle Total 6-2 defined as (3+4)</i>
9= 6-3	<i>Rear Trailer Axle Total 6-3 defined as (5+6)</i>
10= 6-4	<i>Total Truck Weight 6-4 defined as (1+2+3+4+5+6) or (7+8+9)</i>
11= 6-5	<i>Trailer Center of Gravity (distance behind the front trailer axle) 6-5 defined as (9/(8+9))*k20. Replace the k20 with the distance between axles. This formula makes the assumption that left to right balance is irrelevant.</i>

Example Math Channel Entries

(1+2)*k2	Adds scan channels (sc) 1 to 2 and multiplies the result by 2.
l1-2l	Returns the absolute value of the difference of sc1 and sc2. Useful for balance set points.
r((1*1)+(2*2))	Determines square root of the sum of the squares. Useful for vector force calculations.
(1+2+3+4)/k4	Returns the average of sc1 thru sc4
1/2	Returns the ratio of sc1 to sc2

- 1*k31.103 Converts grams (unit of sc1 must be grams) to troy ounces
- 1*k2240 Converts pounds (unit of sc1 must be pounds) to long tons
- (1/(1+2))*k10 Calculates center of gravity from two weights. Returns the distance from center of weight 1. Replace the '10' with the distance between the center of the scales.



Conceptual cheap-platform based truck scale. Provides wheel weights, 3 axle weights, and overall truck weight through the use of Math Channels. Uses 1-9008 Multiplexer with the Model 9000 CellScale.



Math Channels are a versatile, powerful tool and open up many application possibilities.

SETUP PRODUCT ID CODES

Main CellScale Menu → (5) Product IDs

```

***** Product Data *****

(1) Show the next ID
(2) Show the previous ID
(3) Find/Create an ID
(4) Show statistics for this ID
(5) Show summary of all IDs
(ESC) Exit
*****

(a) Product ID (# 11) name:
(b) Channel (1-1) name: Platform 1
(c) Status: Active
(d) Units: Pounds
(e) Tare weight: 0. Pounds
(f) Total weight: 0. Pounds
(g) # of totals: 0
(h) String 1: -----
(i) String 2: -----
    
```

- 1) Use the [1] key to scroll through already programmed IDs. Each channel in the scan list automatically has 1 Product ID.
- 2) Use the [2] key to backspace through already programmed IDs.

Main CellScale Menu → (5) Product IDs → (3) Find or Create a Product ID name or (a) Edit / Add name

```

Enter a product ID name (up to 8 chars):
    
```

To add a product ID to any channel, first scroll to a product ID that uses the same input channel (there's always at least 1 ID per input channel or math channel), then type 3. Type in up to eight characters. If an ID with this name already exists, the CellScale will switch to it. If it does not exist, a new ID is created.

Main CellScale Menu → (5) Product IDs → (4) Show Statistics for this ID

```

***** Product Data Statistics *****

(1) Show the next ID
(2) Show the previous ID
(3) Show main data for this ID
*****

(a) Product ID (# 11) name: davehome
(b) Channel (1-1) name: dave3

(c) Average weight: 0. Pounds
(d) Largest total added: 0. Pounds
(e) Smallest total added: 0. Pounds
(f) Standard deviation: 0.000000 Pounds
(g) Coefficient of variance: 0.0000
    
```

Selections c-g are the statistics for this ID and are intended for information only. Using the terminal from c-g will bring up a screen for clearing the Total. All statistics are based on the total function and are cleared along with total. The CellScale uses the Total modes to provide data for statistics. Only those weighments that are totaled will contribute to statistics data.

Main CellScale Menu → (5) Product IDs → (6) Show summary of all IDs

```

***** Product ID Summary *****

(n)      Show the next      page of IDs
(p)      Show the previous page of IDs
(ESC)    Exit
*****
ID #   Name      Ch-Sub   Status   Current Wt.  Units
-----
  1                LC 1-1   Active      2          Pounds
  2  this is     LC 1-2   In-active           Kilograms
  3                LC 1-3   Active     432          Tons
  4                LC 1-4   Active      6.7         Pounds
  5  Number1    LC 1-2   In-active           Kilograms
  6  Number2    LC 1-2   Active     432          Kilograms
  7                Undefined
  8                Undefined
  9                Undefined
 10                Undefined

Type a command or an ID number and (RETURN):
    
```

This screen provides a listing of all IDs. Use the [p] key to observe other pages of ID codes. Incidentally, this is the only screen that allows observing up to 10 active channels at once.

Activate, Deactivate, or Delete a Product ID

You can activate, deactivate, or delete IDs using the “Status” [c] command in the Product Data menu.

Main CellScale Menu → (5) Product IDs

```

***** Product Data *****

(1)      Show the next      ID
(2)      Show the previous ID
(3)      Find/Create an    ID
(4)      Show Target Parameters
(5)      Show statistics for this ID
(6)      Show summary of all IDs
(ESC)    Exit
*****
(a)      Product ID (# 11) name:
(b)      Channel (1-1) name: Platform 1
(c)      Status: Active
(d)      Units: Pounds
(e)      Tare weight: 0. Pounds
(f)      Total weight: 0. Pounds
(g)      # of totals: 0
(h)      String 1: -----
(i)      String 2: -----
    
```

- 1) Use the [1] key to scroll through already programmed IDs. Stop on the ID you wish to change.
- 2) Press the [c] key to bring up the ID status menu.

```

***** Product Data Status *****

(1)      Make this ID active
(2)      Make this ID in-active
(d)      Delete this ID
(ESC)    Exit
*****

(a)      Product ID (# 1) name: test1
(b)      Channel (1-1) name: Platform A
(c)      Status: In-active
    
```

- 3) To activate this ID (and deactivate any other ID assigned to this scan list position, press [1]. To deactivate press [2]. To delete the ID Code and all associated data, press the [d] key. When deleting, the following



screen appears.

```
You are about to delete this ID
Are you sure??
Type YES to complete this action.
Type NO  to abort  this action.
```

- 4) This screen only responds to “YES” and each letter must be upper case. Any other letter entered here will abort the deletion process and leave the ID Code intact.

SECTION 6 – SET POINTS

INTRODUCTION

The CellScale system provides extensive Set Point capabilities. Up to 32 Set Points are available. The CellScale performs the A/D conversions and does limit checking for all the Set Points. Any connected 3750CS receives Set Point information from the CellScale and responds as programmed.

All 32 Set Points are setup from either the CellScale Terminal Interface, or from a 3750CS, 9750A, or 9850 Indicator. All Set Point value parameters are stored in the CellScale and are independent of any other device, including the three indicators. When a Set Point is tripped (true condition), the CellScale transmits to all connected indicators a message signifying which Set Point tripped. A user programmed message is also sent to any comm port specified when the Set Point trips. An optional Set Point Off message is also available which is sent when the set point resets. Combined with the MSI @ codes, set point messages can form the basis of an extensive maintenance tool, or a record of all events.

3750CS Set Point Parameters

Any 3750CS installed on a CellScale Network will respond to Set Points transmitted by the CellScale. A 3750CS can respond to the Set Point transmission in several ways:

- 1) Close a relay (Set Points 1–8 w/ option board).
- 2) Turn on an LED indicator (Set Points 1–2).
- 3) Blink the LCD weight reading (Set Points 1-32).
- 4) Blank the LCD weight reading (Set Points 1-32).
- 5) Display a message on the lower alphanumeric display (Set Points 1-32). These messages are programmed and stored in the 3750CS and are not related to the messages in the CellScale.
- 6) Send a message out the RS-232 port of the 3750CS (Set Points 1-32). This message can include weight parameters, time, date, and any random text the user requires (using MSI @ codes).

These actions are independent of what the CellScale does, and are independent of other 3750CS's that might be on the Network. These Set Point actions are stored only in the 3750CS and must be programmed independently in all 3750CS's used in the system.

9750A Set Point Parameters

Any 9750A Handheld Indicator installed on a CellScale Network will respond to Set Points transmitted by the CellScale. A 9750A can respond to the Set Point transmission in several ways:

- 1) Audible Alarm – 4 unique tones available for both set and reset conditions.
- 2) Display a message on the alphanumeric display in 3 font sizes. Using the large font size, the whole display provides a set point indication. The medium font size takes over the bottom two lines with up to 16 characters. The small font size takes over the bottom line with up to 20 characters.
- 3) Send a message out the RS-232 port of the 9750A. This message can include weight parameters, time, date, and any random text the user requires (using MSI @ codes).

These actions are independent of what the CellScale does, and are independent of other indicators that might be on the Network. These Set Point actions are stored only in the 9750A and must be programmed independently in all Indicators used in the system.

9850 Set Point Parameters

Any 9850 CellScale Indicators installed on a CellScale Network will respond to Set Points transmitted by the with the same feature set as the 9750A, but adds various relay closure options depending on the options installed in the 9850.

Parameters stored in the CellScale

All parameters related to the Set Point values are stored only in the CellScale, but can be programmed from any RF connected CellScale Indicator. These parameters include the following:

- 1) One or two threshold values (Value 1 and Value 2).
- 2) An “Operator” for each value (Oper 1 and Oper 2) which specifies whether the Set Point is Less Than, Greater Than, etc.
- 3) An Operator Relationship (Op Relat) which specifies an “AND” or “OR” relationship between Value 1 and Value 2.
- 4) A “Trigger Type” for each value (Trigtyp1 and Trigtyp2) which specifies if the Set Point responds



to Gross weight, Net weight, Total weight, or number of samples in the total (nSamples). “nSamples” can also be thought of as a box counter or load counter.

- 5) Preact, Postact, and Deadzone – These parameters modify the value of the Set Point for process control applications. The effect of these value modifiers is detailed below.
- 6) Input Source – This parameter relates the Set Point to a position in the Channel List. This allows any Set Point to be assigned to any input channel or Math channel in the Cell Scale. The Channel list must be configured in the CellScale. It cannot be programmed from the 3750CS.
- 7) Output Destination – The output destination list is also configured in the CellScale and is used to direct Set Point outputs at the CellScale end.
The Output Destination list must be configured in the CellScale. It cannot be programmed from the 3750CS.
- 8) Latching – Any Set Point can be configured to Latch on when tripped so even when the set point is no longer true the output remains on.
- 9) Delay – Any Set Point can be delayed by up to 10 seconds (10000 ms). Often used to prevent spurious Set Point outputs.
- 10) On/Off – Any Set Point can be turned on or off independently from the rest without losing any programmed parameters.
- 11) All Set Points On/Off – Used to disable the operation of all 32 Set Points.

Operator Relationship, 2 Threshold Set Points

The CellScale can perform In-bounds and Out-of-bounds checking or grading by using the dual threshold feature of the Set Points. By specifying both a “Value 1” and a “Value 2” and establishing whether the values are to be “ANDed” or “ORed” the user can have complete control over the action of the Set Points.

For example, a Set Point can trip when the weight is >100kg AND <200kg which provides an in-bounds comparison. A Set Point can trip when the weight is <100kg OR >200kg which provides an out-of-bounds comparison.

The CellScale does not prevent you from entering >100kg AND >200kg which would trip when the weight was over 200kg. Just make sure your formula makes sense.

The Trigger Type parameter allows advanced capabilities such as Set Points that are conditional on weight and totals. For example set Value 1 to >1000kg with a trigger type of Gross, and set Value 2 to ≥100000kg with a trigger type of Total. Set the Operator Relationship to “OR”. This will yield a Set Point that trips on each load over 1000kg, and stays tripped when the total load is ≥100000kg.

Preact, Postact, and Deadzone

To illustrate the effect of these three parameters, let’s assume a set point is set for >1000kg. The value placed in Preact, Postact, or Deadzone is 20kg:

Preact – Set Point trips on >980kg (1000-20) and off at <980kg.

Postact – Set Point trips on >1020kg (1000+20) and off at <1020kg.

Deadzone – Set Point trips on at 1000kg. Turns off at 980kg.

Although the CellScale allows it, it never makes sense to program a Preact and a Postact for the same Set Point, since they would cancel each other out. However, it is sometimes desirable to combine Preact or Postact with Deadzone. This would provide hysteresis to the relay or hopper valve and prevent “chatter”. To illustrate this, building on our previous example: Set point value is >1000kg, preact is 20kg, deadzone is 4kg:

Set Point trips on at 980kg, trips off at 976kg

When a Set Point is set for “less than”, then Preact, Postact, and Deadzone work in the opposite direction. Let’s again assume a set point is set for 1000kg, but now <1000kg. The value placed in Preact, Postact, or Deadzone is 20kg:

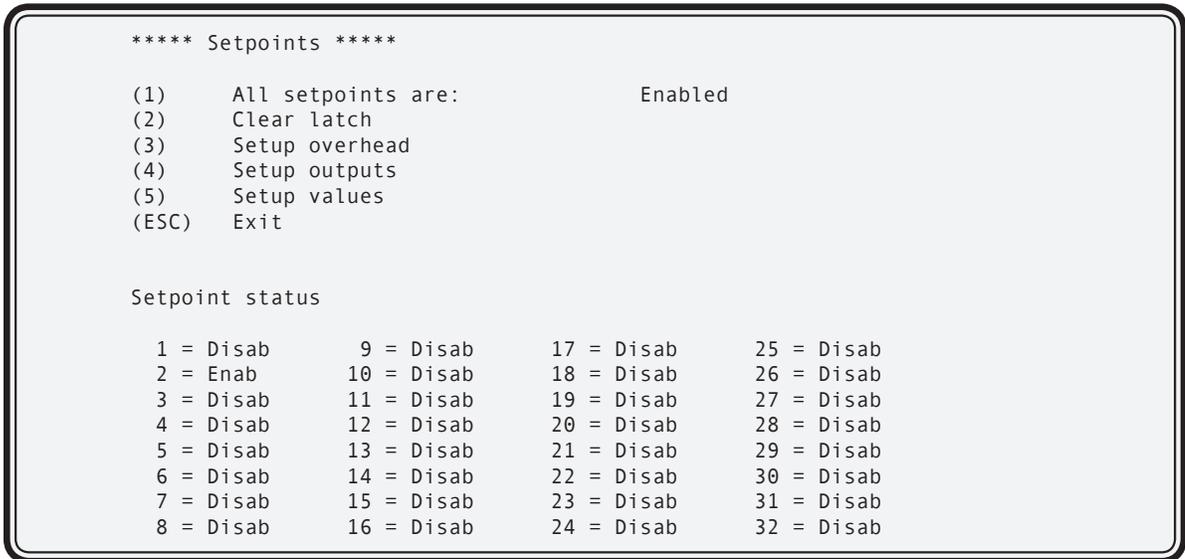
Preact – Set Point trips on <1020kg (1000+20) and off at >1020kg.

Postact – Set Point trips on <980kg (1000-20) and off at >980kg.

Deadzone – Set Point trips on at <1000kg. Turns off at 1020kg.

For dual value Set Points, Preact, Postact, and Deadzone apply equally to both values with the same rules illustrated above.

SET POINT SETUP MENU



1) All Set Points are:

Used to disable and enable all 32 Set Points at once. Set Points must be individually enabled as well.

2) Clear latch

If a set point is latched, pushing 2 will clear the latch. If the condition is still true for the latched set point, clear latch will not work.

3) Setup Overhead

Overhead includes individual enable/disable for each set point, assigning a name, delay, latching, and input position from the scan list, and output position from the SP Output list.

4) Setup Outputs

Program the set point output list. Add set point messages, program the internal relays, and add external relays.

5) Setup Values

Program set point values for all 32 set points.

Set Point Status

The Set Point status screen shows the operational status of all 32 set points. ‘Disab’ means the set point is not enabled. ‘Enab’ indicates the set point is enabled, but the trigger condition is false. ‘Trig’ indicates the set point is triggered (true).

EXAMPLE SET POINT PROGRAMMING

Programming 32 Set Points takes careful planning. To assist in planning 1 to 32 Set Points see Appendix E, Set Points Worksheet. The Set Points Worksheet is a form that details all the capabilities of each of the 32 Set Points. Once planned, the entry of data, using either the CellScale Terminal Interface or the 3750CS menus, is greatly simplified.

Filling out the Set Points Worksheet

The worksheet has 32 identical sections for set points 1-32.

- 1) Decide on a name for the set point. This step is optional but it aids in identifying the set point as well as allows the name to be included in messages. Up to 8 characters are allowed.
- 2) Enter > (greater than), ≥ (greater than or equals), < (less than), or ≤ (less than or equals) in front of SP Value 1 to determine how the sp value compares with the input.
- 3) Enter value 1 for the set point. The value is entered in the calibration unit of the assigned input channel.

If the input channel for any set point is changed, the numbers stay the same but the unit changes to the assigned channels



unit. However, changing the units of the input channel will not effect the actual weight value.

- 4) Assign a trigger type for Value 1. Choices are: Gross - value is compared using the gross weight no matter what the mode of the channel is. Net/Gross - value is compared to the current net weight, if in net mode, or gross weight if in gross mode. Total - value is compared to the current IDs total. nSamples - value is compared to the number of weighments totaled (e.g. box counter).
- 5) If a dual threshold set point is needed determine the relationship of the two values ('and', 'or') and write it in the "Op Relationship" location. If a single threshold set point is appropriate, write 'none' and skip to step 9.
- 6) Enter > (greater than), \geq (greater than or equals), < (less than), or \leq (less than or equals) in front of SP Value 2 to determine how the sp value compares with the input.
- 7) Enter value 2 for the set point. The value is stored in the calibration unit of the assigned input channel.
- 8) Assign a trigger type for Value 2. Usually the trigger type should match that of value 1. However there are interesting things that can be done such as, for example, stop triggering once the total weight is above 50000.
- 9) Optional - If preact, postact, or dead zone is needed, fill in the Value modifier section. See discussion on preact, postact and dead zone in the set points introduction section.
- 10) Optional - Add delay if desired. Delay is used to prevent transients from triggering the set point. for most scale systems a delay of up to 1000ms (1 second) is appropriate.
- 11) Optional - Enter messages for the set point. The messages can provide information about the set point event. Include MSI '@ Codes' to add values, times, dates, etc.. The "Set Point On" string is transmitted when the Set Point is triggered. The "Set Point Off String" is transmitted once when the Set Point resets. There is a separate section for the 3750CS. This message is stored in the 3750CS and cannot be programmed from the CellScale. The 3750CS message occurs only when the Set Point is triggered.
- 12) Input Channel - Each set point must have an input channel for data. In single channel systems, this will always be '1'. In systems with multiple channels, use the scan list as a reference.
- 13) Output Channel - The CellScale has 32 output setups which any set point can use. Each SPOutList position supports up to 10 output actions. The setup of the SPOutList is covered later using the "Set Points Output List Worksheet". Refer to the worksheet when assigning an output to the Set Point.

The LCD Mode and LCD/Comm selection fields are used only for 3750CS setup. They have no effect on the CellScale.

Repeat the steps above for all needed set points. Once the worksheet is completed, use the following procedure to enter the set points into the CellScale.

Programming Set Points

- 1) Connect a terminal to the CellScale. This can be a computer with virtually any terminal emulation software. Set the terminal program for 9600 baud, 8 bits, no parity, 1 stop bit, and no handshaking.
- 2) Press **[Return]** to refresh the menu. Once connected, the following screen should appear.

```

----- MSI 9000 - CellScale -----
- (c) 2006 Measurement Systems International -
-----

05:23:26 PM                                01/09/06

(1)   Channels/Calibration
(2)   Communications
(3)   Display
(4)   Feature Locks/Passwords
(5)   Product IDs
(6)   Set Points
(7)   System
(8)   About...

Enter choice :
```

- 3) Select the Set Points menu by typing 6. The following menu will appear. This is the main set points setup menu. If number '1' is in the enabled state, I'd recommend you disable while programming new set points. This will prevent outputs occurring during the programming phase. Once all set points are set up you can easily enable them with the 1 key in this menu.

```

***** Setpoints *****

(1)   All setpoints are:           Enabled
(2)   Clear latch
(3)   Setup overhead
(4)   Setup outputs
(5)   Setup values
(ESC) Exit

Setpoint status

  1 = Disab    9 = Disab    17 = Disab   25 = Disab
  2 = Enab     10 = Disab   18 = Disab   26 = Disab
  3 = Disab    11 = Disab   19 = Disab   27 = Disab
  4 = Disab    12 = Disab   20 = Disab   28 = Disab
  5 = Disab    13 = Disab   21 = Disab   29 = Disab
  6 = Disab    14 = Disab   22 = Disab   30 = Disab
  7 = Disab    15 = Disab   23 = Disab   31 = Disab
  8 = Disab    16 = Disab   24 = Disab   32 = Disab
```

Setup Set Point Overhead (3)

- 1) First we'll configure set point overhead parameters. Push **[3]**. The following menu will appear. If a set point has been previously programmed, its parameters would show here.



```

***** Setpoint Overhead *****

(1)   Setpoint being configured:      4
(2)   Enabled/Disabled:                Disabled
(3)   Name:
(4)   Input position in ScanList:      1
(5)   Output position in SPoutList:    4
(6)   Delay before trigger:           0 msec
(7)   Latching:                       Disabled
(ESC) Exit
    
```

If previously programmed, the set point trigger formula will display in this area.

- 2) Select the set point by pushing [1]. This brings up a number entry screen. Enter from 1-32 as the set point you are programming.
- 3) Push [3] to input up to 8 characters as a name.
- 4) The input position defaults to scanlist position 1. If this set point should respond to a different channel in the scan list, push [4]. The CellScale helps you by showing the scan list. Pick an entry that is already active. If you pick an inactive scan list position, you must make the scan list position real in order for this set point to do anything.

Setpoint # 4 will get its input from scanList position (1 - 32):

ScanList position = channel-subChannel

1 = 1-1	9 = ---	17 = ---	25 = ---
2 = 1-2	10 = ---	18 = ---	26 = ---
3 = ---	11 = ---	19 = ---	27 = ---
4 = ---	12 = ---	20 = ---	28 = ---
5 = ---	13 = ---	21 = ---	29 = ---
6 = ---	14 = ---	22 = ---	30 = ---
7 = ---	15 = ---	23 = ---	31 = ---
8 = ---	16 = ---	24 = ---	32 = ---

In this example we'll pick scan list position 2 by pushing [2] then [Return]. The overhead menu reappears.

```

***** Setpoint Overhead *****

(1)   Setpoint being configured:      4
(2)   Enabled/Disabled:                Disabled
(3)   Name:
(4)   Input position in ScanList:      2
(5)   Output position in SPoutList:    4
(6)   Delay before trigger:           0 msec
(7)   Latching:                       Disabled
(ESC) Exit
    
```

If previously programmed, the set point trigger formula will display in this area.

- 5) The CellScale automatically assigns a Output position of the same number as the set point. However, many set points can share the same output if desired. See "Setup Set Point Outputs" later in this section.
- 6) Optional - Press [6] to input a delay for the set point. The set point must remain true the length of the delay before it will trigger. The delay is used to eliminate spurious or transient events from triggering set points.

For example we'll enter a 1 second delay (1000ms), by typing 1000[Return].

Enter setpoint # 4 trigger delay (0 - 10000 msec): 1000

```

***** Setpoint Overhead *****

(1) Setpoint being configured:      4
(2) Enabled/Disabled:              Disabled
(3) Name:
(4) Input position in ScanList:     2
(5) Output position in SPoutList:   4
(6) Delay before trigger:           1000 msec
(7) Latching:                      Disabled
(ESC) Exit

```

If previously programmed, the set point trigger formula will display in this area.

- 7) Optional - Press [7] to enable latching. Latching causes the set point to remain triggered even after the conditions are no longer true. Primarily used in safety concerns to cause inspections of possible overloaded weight bearing elements. The latch is cleared either with the clear latch command on the set points menu, or by a 3750CS.

This completes a typical overhead setup for 1 set point. Repeat the process for all set points needed. When finished, push [ESC] to return to the main Set Points Menu.

Setup Set Point Values

Now set the values as entered on the worksheet for the formula used by each set point.

- 1) From the Set Points Menu select "Setup Values" by pushing [6]. The Set Point Values menu appears.

```

***** Setpoint Values *****

(1) Setpoint being configured:      4,
(2) Operator relationship:          None
(3) Operator #1:                   None
(4) Operator #2:                   None
(5) Value #1:                      0.
(6) Value #2:                      0.
(7) Value #1 weight type:          Gross
(8) Value #2 weight type:          Gross
(9) Pre -act:                      0.
(a) Post-act:                      0.
(b) DeadZone:                      0.
(ESC) Exit

```

- 2) Select the set point number by pressing [1].
- 3) Select the numeric operator for value 1 by pressing [3]. In this example, we'll use 'greater than'. Once selected the formula bar appears at the bottom of the screen.



```

***** Setpoint Values *****

(1)   Setpoint being configured:      4,
(2)   Operator relationship:           None
(3)   Operator #1:                    Greater than
(4)   Operator #2:                    None
(5)   Value #1:                       0.
(6)   Value #2:                       0.
(7)   Value #1 weight type:           Gross
(8)   Value #2 weight type:           Gross
(9)   Pre -act:                       0.
(a)   Post-act:                       0.
(b)   DeadZone:                       0.
(ESC) Exit

If (grs wgt > 0.      )  s/p triggers
If (grs wgt <= 0.    )  s/p resets

```

- 4) Input value 1 by pressing [5]. The value entry screen appears. The units are determined by the input channel. If the input channel has not yet been selected the units will remain blank. In our example we'll enter 1200 kg for value 1 (1200[Return]).

```
Type in the new value #1 (in Kilograms ): 1200
```

The set point value menu reappears with the 1200 parameter set. Note the formula at the bottom of the screen shows the current programming - If gross weight is Greater than 1200 the the set point triggers. If the gross weight is less than or equal to 1200 the set point resets.

```

***** Setpoint Values *****

(1)   Setpoint being configured:      4,
(2)   Operator relationship:           None
(3)   Operator #1:                    Greater than
(4)   Operator #2:                    None
(5)   Value #1:                       0.
(6)   Value #2:                       0.
(7)   Value #1 weight type:           Gross
(8)   Value #2 weight type:           Gross
(9)   Pre -act:                       0.
(a)   Post-act:                       0.
(b)   DeadZone:                       0.
(ESC) Exit

If (grs wgt > 1200.  )  s/p triggers
If (grs wgt <= 1200. )  s/p resets

```

- 5) Select the desired weight type (from the worksheet) with the [7] key. Choose from 'Gross', 'Net/Gross', 'Total', and '# Totals'.
- 6) If a dual threshold set point is desired select the operator relationship using the [2] key. Choose from 'And' or 'Or'. Choosing none will cause the set point to ignore anything set in value 2.

SET POINT MESSAGES

Each Set Point has two text strings available. The "ON string" is sent once when the set point is triggered (conditions are true). The "OFF string" is sent once when the set point is cleared (not true). Both strings are optional, but at least 1 string must be programmed for anything to appear at a comm port due to a set point being triggered. The strings are up to 64 bytes in length and can include MSI "@" codes to add weight data or any other data available. Using @ codes can extend the length of the set point message considerably. See the "@ Commands" section of this manual for more information. Set Point strings are associated to the Set Point, not to the SP Output list.

Strings, once programmed, can be sent to any serial device wired directly to the CellScale, or through one of the “virtual” Comm Ports 3-5 connected via RF with 9020 CellModems. You can also send a message to the terminal interface program in a dialog box that will interrupt the current terminal function. Where the message is sent is dictated by the assigned SP Output List.

SET POINT OUTPUT LIST

There are 32 available SP Output List configurations. This allows each possible Set Point a unique output. However Set Points can share the same output if desired. Add set point messages, program the internal relays, and add external relays connected via RS-485 or CellModems. Use the Set Points Output List Worksheet to organize your output configurations.

There is no association between the Set Point number and the Output List Number. Any Set Point can access any Output List position. For example, if your goal is to warn of dangerous conditions by turning on an alarm with a relay, all set points can use a single Output list position. Therefore if any set point is triggered the alarm will sound.

Each Set Point (up to 32), when triggered will perform the actions dictated by the SP Output List. Each Listing in the Output List can have up to 10 actions designated by a-j in the SPoutList menu. This structure allows complex combinations of messaging as well as relay closures. A single relay can be addressed by any or all 32 set points. Conversely a single set point can trigger multiple relays.

The following menus are used to program the set point messages and the set point output list.

Setup Set Point Outputs

1) From the Set Points Menu select “Setup outputs” by pushing [4]. The Setup SPoutList menu appears.

```

***** Setup SPoutList *****

(1) Set point being configured: 1,
(2) Set point ON string:
(3) Set point OFF string:
(4) Output position in SPoutList: 1
(5) Add an output
(6) Delete an output
(7) Clear the position
(ESC) Exit

SPoutList position 1

(a) available (f) available
(b) available (g) available
(c) available (h) available
(d) available (i) available
(e) available (j) available
    
```

2) Push the [1] key to select the desired set point to add strings or outputs to.

```

Type the set point to configure (1 - 32):

Set point status

1 = Disab    9 = Disab    17 = Disab   25 = Disab
2 = Disab    10 = Disab   18 = Disab   26 = Disab
3 = Disab    11 = Disab   19 = Disab   27 = Disab
4 = Disab    12 = Disab   20 = Disab   28 = Disab
5 = Disab    13 = Disab   21 = Disab   29 = Disab
6 = Disab    14 = Disab   22 = Disab   30 = Disab
7 = Disab    15 = Disab   23 = Disab   31 = Disab
8 = Disab    16 = Disab   24 = Disab   32 = Disab
    
```

3) Choose the Set Point you wish to add outputs to. Type the number followed by a [Return]. In this example, we'll add outputs to Set Point 5. The CellScale assumes that each Set Point will need a unique output



and preassigns a matching output list position. If you want to use a different output position or share one previously setup, you can change it with the [4] key.

```

***** Setup SPoutList *****

(1)   Set point being configured:   5,
(2)   Set point ON  string:
(3)   Set point OFF string:
(4)   Output position in SPoutList:  5
(5)   Add an output
(6)   Delete an output
(7)   Clear the position
(ESC) Exit

SPoutList position 5

(a)   available           (f)   available
(b)   available           (g)   available
(c)   available           (h)   available
(d)   available           (i)   available
(e)   available           (j)   available

```

- 4) Add a Set Point message by pushing [2] for the ON string or [3] for the OFF string. The strings are up to 64 bytes in length and can include any ASCII character as well as upper register characters (128d-255d). Also any MSI @ code can be included in the string. The following string entry menu appears.

```

***** Edit a Data String *****

(1)   Enter string by typing on keyboard
(2)   Enter Hex-ASCII value
(d)   Initialize to defaults
(ESC) Exit

Pos  Cur   Hex      Set point #5 ON  string
0    <nul> 0x00    -----
          ^

```

- 5) To enter the string using the keyboard type [1]. To enter a value not easily found on your keyboard, use an ASCII chart and enter the value in Hex using the [2] key. A value not easily displayed will be place held by an asterisk. The Pos readout indicates the cursor location and helps keep count of the string size. The Cur readout displays the ASCII value of the entry if it exists, and the Hex readout displays the value in Hex of the cursor location.

After entering the string, use the [ESC] key to store and return to the previous menu. This procedure is the same for either the ON string or the OFF string.

Example message: “Hoist Overload” with the weight, time, and date attached. This string would read “Hoist Overload @W1 @T1 @D1 @E”.

- 6) To add an output push the [5] key from the Setup SPoutList menu. The following menu will appear.

```
***** Add an output to SPoutList *****
```

```
(1)   SPoutList position:           5
(2)   Dialog box to terminal
(3)   Send string to a commport
(4)   On board relay 1
(5)   On board relay 2
(6)   On board relay 3
(7)   External relay
(ESC) Exit
```

```
SPoutList position 5
```

```
(a) available          (f) available
(b) available          (g) available
(c) available          (h) available
(d) available          (i) available
(e) available          (j) available
```

- 7) Adding outputs is simply a matter of picking from the menu everything you want to happen when the set point triggers. For example, this set point 5 when triggered, should close a relay, and send a message to a printer attached to Comm 1. To get this string to print when set point 5 is triggered type [3]. The following entry screen appears.

```
***** Set point output *****
```

```
(1)   Send string to com 1
(2)   Send string to com 2
(3)   Send string to virtual com 3
(4)   Send string to virtual com 4
(5)   Send string to virtual com 5
(ESC) Exit
```

- 8) Select the desired location. In this example we'll use the hardwired Comm Port 1 by pushing [1]. Note the change to the output list below.

Comm Port 2 is not available if the Radio Link is in use. Only Non-RF versions of the 9000 CellScale can use Comm 2. Comm 3-5 require 9020 Modems connected as Host devices to function.

```
***** Add an output to SPoutList *****
```

```
(1)   SPoutList position:           5
(2)   Dialog box to terminal
(3)   Send string to a commport
(4)   On board relay 1
(5)   On board relay 2
(6)   On board relay 3
(7)   External relay
(ESC) Exit
```

```
SPoutList position 5
```

```
(a) Send string to Comm 1      (f) available
(b) available                  (g) available
(c) available                  (h) available
(d) available                  (i) available
(e) available                  (j) available
```

- 9) Add a relay output using keys [4] - [7]. In this example, we want on board relay 1 to close. Push [4].

The 3 on board Solid State relays are suitable for many tasks, but are not suitable for large motors or high current application. To drive high amperage or voltage devices, use the on-board relays to drive an external hi-power relay. 24Vdc coils are common for this application.

```

***** Add an output to SPoutList *****

(1)   SPoutList position:           5
(2)   Dialog box to terminal
(3)   Send string to a commport
(4)   On board relay 1
(5)   On board relay 2
(6)   On board relay 3
(7)   External relay
(ESC) Exit

SPoutList position 5

(a) Send string to Comm 1      (f) available
(b) On board relay 1          (g) available
(c) available                  (h) available
(d) available                  (i) available
(e) available                  (j) available

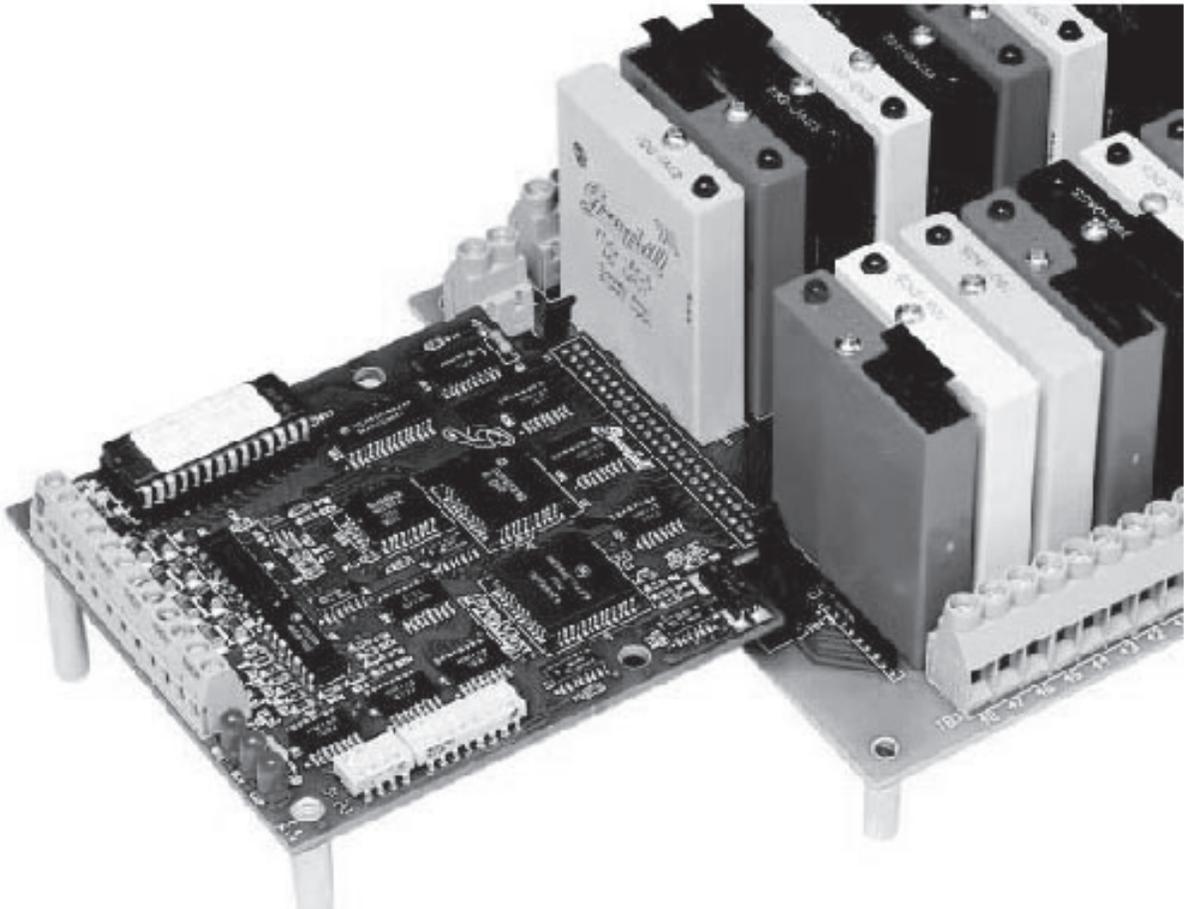
```

3750CS Meters also have internal relays available as an option. These relays are not programmed here. They trigger when the corresponding Set Point is true and are limited to Set Points 1-8.

USING EXTERNAL RELAYS

The CellScale is capable of communicating with I/O modules (limited to Outputs with software released to date) through Grayhills ProMux controller boards.

The ProMux[®] controller board mates with any of Grayhills (other brands too) 8, 16, or 24 digital module racks. Plug standard, miniature, or G5 digital I/O modules into the racks. They can be mixed in any combination. Connect the ProMux[®] boards serially to the CellScale Comm Port 1 or a CellModem RS-422 output, and



ProMux Adapter Board (Photo courtesy of Grayhill Corporation)

the set points will control the outputs.

The CellScale and ProMux® boards communicate serially over two pair of twisted wires per RS-422/485 in either a multi-drop or repeat configuration. Setup of communications with the Pro Mux boards is covered in the Communications menu. Be sure to match baud rates. The ProMux controller boards use DIP switches for Baud Rate control.

Each ProMux controller board has a base address and then each output device has an address as well. Once the DIP switches are setup on the ProMux board, the CellScale can be programmed to match.

- 1) Setup a Comm Port to communicate with the Grayhill ProMux board by choosing “Grayhill ProMux” under the Type command (see Comm Port Setup on page 40). Make sure baud rate and data bits match.
- 2) RS-485 and RS-422 lines must be properly terminated with 120Ω resistors and a ground reference must be provided. Lengths of cabling can be up to 4000 feet (1200m) but proper twisted pair cable and termination techniques must be carefully followed to ensure reliable operation at long distances. Using the CellModem instead of long RS485/422 wiring is highly recommended.
- 3) Referring to the ProMux manual assign an address for the ProMux. ProMux boards with more than 8 devices will have two addresses.
- 4) Use the address and relay position when entering the external relay device.

Type the external relay address (Ex 32-4):

- 5) Next type in the CommPort the ProMux board is attached to.

Comm Port 2 is usually not available due to its use for the RF Modem.

Type the external relay address (Ex 32-4): 4-2

Type the com port this board is tied to (1 to 5):

- 6) The external relay as programmed will appear on the output list. Note that more than 1 external relay can be controlled on any output list. Also any output can share any relay.



SECTION 7 – CALIBRATION

The CellScale is calibrated in any of 4 ways: 1) Using the 3750CS RF Meter. Calibration using this method is covered in the 3750CS User Guide. 2) Using the 9750A Handheld Meter. Calibration using this method is covered in the 9750A User Guide. 3) Using the 9850 CellScale Indicator. Calibration using this method is covered in the 9850 User Guide. 4) Via “Virtual Meter” software installed on a PC equipped with a CellModem. See the CVM User Guide. 5) Using the Terminal Access Mode menus. It is this 5th method that is covered here.

Before Calibration, a certain amount of planning is required.

- 1) If there is more than one scale input, the channel list must be programmed first (see section 5). It is suggested that the Channel List & ID Codes worksheet is filled out for all input channels. This provides information useful for calibration, and organizes all the channels for capacity, units, and determines the maximum desired resolution (d).
- 2) Adequate test weights must be available. Full capacity test weights are desired, but a valid calibration can be accomplished with as little as 10% of capacity in test weights. The accuracy of a system calibrated with less than full capacity test weights is entirely dependent on the linearity of the scale transducer.
- 3) The CellScale can take advantage of as many as 9 calibration points (10 counting zero). This allows linearization of non-linear scales. However, accuracy will still depend on repeatability.

Dead Load Compensation

Dead Load is defined as the weight present on the scale caused by structural members or platforms, that imparts a load on the scale transducers. Dead Load must be taken into account when specifying the load cells capacity. For example, a heavy duty floor scale is rated at 10000 lb.. capacity. The rugged steel platform and support structure for the scale weighs 2000 lb., and it is supported with 4 load cells. Each load cell must be specified to 1/4th of the rated capacity plus 1/4th of the dead load. Therefore the Load Cells must be rated to 3000 lb.. It is also a good idea, especially when rugged reliability is the goal, to derate the capacity an additional 20-50% to allow for off center loading. This could bump the capacity of each load cell up to 5000 lb. each in this example. The end result of this is the dead load is 20% of capacity, and the output voltage is half that if we had used 2500 lb. load cells.

The CellScale is capable of calibrating systems with large dead loads, with dead load compensation performed automatically during the zero calibration step. Up to $\pm 200\%$ of capacity dead load are eliminated with a built-in DAC (Digital to Analog Converter). No ADC (Analog to Digital Converter) counts are sacrificed to eliminate dead load, which is an important consideration when output levels are low. The wide range of dead load compensation also provides a means to calibrate tanks and other vessels that still have product inside. See “Calibration of partially full tanks”.

STANDARD SCALE CALIBRATION

The following procedure assumes the scale can be unloaded to perform a zero reading.

- 1) Connect a terminal (or computer with a terminal program) to the CellScale Comm Port 1. Settings for your terminal program are: 9600 baud, 8 bit, 1 start bit, 1 stop bit, no parity, Handshaking usually not required, but you can turn on Xon/Xoff if you desire.
- 2) If the CellScale does not come up in the Terminal Access Mode, send the CellScale the access string ;MSI9MSI9 [Return]. The main menu should appear.



```

----- MSI 9000 - CellScale -----
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-----

13:48:06                                01/02/06

(1)   Channels/Calibration
(2)   Communications
(3)   Display
(4)   Feature Locks/Passwords
(5)   Product IDs
(6)   Set Points
(7)   System
(8)   About...

Enter choice :

```

- 3) Select “Channels / Calibration” by pressing the **[1]** key. The Channel Setup menu appears.

```

***** Channel Setup *****

(1)   Channel Calibration
(2)   Data backup
(3)   Filter (software)
(4)   Channel Scanlist functions
(5)   Motion Compensation (Accelerometer option required)
(6)   Motion Detection
(7)   Tare
(8)   Total
(9)   Units Lock
(a)   Zero
(ESC) Exit

```

- 4) Start the Calibration procedure by pressing **[1]**. The “Choose Channel to Calibrate” menu appears. This menu allows you to select which channel is to be calibrated. It uses the Scan List to identify which channels are available for calibration.

For multiple channel systems, the channel list must be set up before starting the calibration procedure. See Section 4.

```

***** Choose Channel Parameters *****

(1)   Continue. These settings are correct
(2)   Choose the channel to calibrate:      2-2
(3)   Calibration timeout:                  10 minutes
(ESC) Exit

```

- 5) The channel number is changed by pressing **[2]** until the desired channel to calibrate is displayed. Once the correct channel is shown, press **[1]** “Continue ...”.
- 6) The Channel Calibration menu appears. If the CellScale channel has never been calibrated, then you must select **[1]**. If this is a recalibration for the same capacity, count-by (d) and calibration units, then you can skip to step 10 by pressing **[2]**. Press **[2]** only if the settings at the bottom of the screen match the capacity and resolution requirements.

```

***** Channel Calibration *****

(1)   Perform a completely new calibration
(2)   Re-do the current calibration
(3)   Manually adjust current cal points
(4)   Reset all cal parameters to defaults
(ESC) Exit

Calibrate channel #:          1-1
The channel name is:         Fred2.....
Calibration Capacity:        1000.0
Calibration Countby:         0.2
Calibration Units:           Pounds
    
```

7) The CellScale prompts for the calibration unit. Chose the desired unit. In this example we'll choose kilograms (2).

Your choice of calibration unit does not prevent you from displaying the weight in any other unit. Select the unit matching your test weights.

```

***** Choose Calibration Units *****

(1)   Pounds
(2)   Kilograms
(3)   Tons
(4)   Metric Tons
(5)   Ounces
(6)   Grams
(7)   Dekka-Newtons

Type a key...
    
```

8) The CellScale next prompts for the capacity. With the numeric keys, enter the capacity of the scale. In our example we'll enter 10,000 kg.

The capacity represents the highest operating value of the system. The actual overload point is a few scale divisions above the entered capacity depending on the legal-for-trade settings.

```

Type in the new capacity:          kg
    
```

9) The CellScale next prompts for the count by (d). The list presented is calculated by the processor according to the type of transducer as set up in the channel list. In this example we'll select [b] to provide 5000 counts.

This list is for a type 'A' scale with up to 10000 counts resolution. This is the standard default.

```

***** Select a countby *****

(a)   1.   Kilograms
(b)   2.   Kilograms
(c)   5.   Kilograms
(d)   10.  Kilograms
(e)   20.  Kilograms
(f)   50.  Kilograms
(g)   100. Kilograms
    
```

10) The first actual calibration step is zero. Unload the scale, make sure it is stable, and press [Y]. The scale performs its zeroing step, removing all dead load. This process takes up to 4 seconds.



```

***** Channel Calibration *****

Calibrating Ch # 1-1, named:   Test2.....
Precision in Kilograms   :           10000. x 2.

Test weight #  0 in Kilograms :           0.

Unload the scale.
Press (Y)   when scale is unloaded and steady
Press (B)   to backup
Press (ESC) to exit calibration

Raw A/D counts: 1900709
    
```

The number presented on the screen is direct A/D counts. This is for troubleshooting only. This number will never be steady as it represents 24 bits. The calibration step needs the scale platform to remain steady and unloaded during this step.

- 11) Next the CellScale prompts for the value of the first test weight. This step defaults to capacity. If this is what you want push **[Y]** otherwise push **[N]** to input the actual cal weight. In our example, we'll use a 5000 kg test weight first.

```

***** Channel Calibration *****

Calibrating Ch # 1-1, named:   Test2.....
Precision in Kilograms   :           10000. x 2.

Test weight #  0 in Kilograms :           0.

Test weight #  1 in Kilograms :           10000.
Press (Y)   if this is correct
Press (N)   to change
Press (B)   to backup
Press (ESC) to exit calibration
    
```

It does not matter if you cal from high to low, or low to high, or any order at all. The CellScale calibration routine works in any order.

- 12) Press **[n]**. Type in the test weight value and enter it using the return key. In this example we're using 5000 kg as the first test weight.

```

Type in the new test weight value:   5000   Kilograms
    
```

```

***** Channel Calibration *****

Calibrating Ch # 1-1, named:   Fred2.....
Precision in Kilograms   :      10000. x 2.

Test weight #  0 in Kilograms :      0.
Test weight #  1 in Kilograms :     5000.

Load the scale with test weight #  1
Press (Y)   when scale is loaded and steady
Press (B)   to backup
Press (ESC) to exit calibration

Raw A/D counts: 1675807
    
```

- 12) Load the scale platform with the indicated test weight (5000 kg for our example). When the scale is stable push 'Y'.
- 13) The CellScale calibrates with the first test weight, and then presents the following menu. The upper half of the screen indicates the two cal steps taken so far, zero and a 5000 kg test weight. If this two point calibration is adequate for the application (in most well designed scale systems, it is), the [ESC] key can be pressed to end calibration, and store all the calibration constants. However if additional test weights are applied, repeat steps 10 and 11 until finished. Up to 9 span points can be calibrated. Any time it is deemed that enough points have been entered, pushing the [ESC] key will end the calibration and store the constants in calibration memory.

```

***** Channel Calibration *****

Calibrating Ch # 1-1, named:   Fred2.....
Precision in Kilograms   :      10000. x 2.

Test weight #  0 in Kilograms :      0.
Test weight #  1 in Kilograms :     5000.

Test weight #  2 in Kilograms :     2001.
Press (Y)   if this is correct
Press (N)   to change
Press (B)   to backup
Press (ESC) to complete and store calibration
    
```

For clarity we'll add a second cal' point at 2000 kg in this example calibration. Load the scale with the 2000 kg weight. If the display shows the exact right number, this cal point is not needed. In our example, the display showed 2001 (a 1/2 'd' error). We can pull this in with a second point calibration, even though this error probably wouldn't show in a system with a 2kg 'd'.

- 14) Type [n] to bring up the weight entry screen. Type in the correct value for the 2nd test weight. Push return to enter the value.

```

Type in the new test weight value:   2000   Kilograms
    
```



```
***** Channel Calibration *****
```

```
Calibrating Ch # 1-1, named: Fred2.....
Precision in Kilograms : 10000. x 2.
```

```
Test weight # 0 in Kilograms : 0.
Test weight # 1 in Kilograms : 5000.
Test weight # 2 in Kilograms : 2000.
```

```
Load the scale with test weight # 2
Press (Y) when scale is loaded and steady
Press (B) to backup
Press (ESC) to complete and store calibration
```

```
Raw A/D counts: 4528050
```

- 15) Ensure the 2nd test weight is on the scale and steady. When it is, press [Y].

```
***** Channel Calibration *****
```

```
Calibrating Ch # 1-1, named: Fred2.....
Precision in Kilograms : 10000. x 2.
```

```
Test weight # 0 in Kilograms : 0.
Test weight # 1 in Kilograms : 2000.
Test weight # 2 in Kilograms : 5000.
```

```
Test weight # 3 in Kilograms : 2000.
Press (Y) if this is correct
Press (N) to change
Press (B) to backup
Press (ESC) to complete and store calibration
```

- 16) After the second span point calibration, the CellScale rearranges the test weights in ascending order. The following menu appears for cal point 3. This is the end of our example calibration. Push esc to end cal, store constants, and return to the main menu. If more span points are desired, repeat steps 14 and 15.

AUTO ZERO MAINTENANCE (AZM)

AZM is used to adjust out variations at zero caused by debris or water on the scale, temperature drift, and any other minor variation that affects the zero setting. Typically AZM is set to 0.5d or 1d, which is adequate for most modern scale systems. The CellScale allows for a much greater AZM range, up to 255 'd' (legal-for-trade systems have a limited range), for unique applications. Use this feature cautiously as it can zero out large quantities automatically if misapplied.

An example of where this can be advantageous is when packing produce, there is some variation in the weight of the packing boxes. By setting the AZM to equal the largest variation in box weight, the error in weight caused by the box can be eliminated. The key to making this work is that the first amount of produce placed in the box has to weigh more than the AZM range so that the produce isn't also zeroed out.

There are three menu items affecting AZM: menu item 3 enables and disables AZM, menu item 4 sets the AZM range in 'd' (1/2 to 255d where 0=1/2), and menu item 5 which defines the AZM rate...how often the system applies AZM.

- 1) Connect a terminal (or computer with a terminal program) to the CellScale Comm Port 1. Settings for your terminal program are: 9600 baud, 8 bit, 1 start bit, 1 stop bit, no parity, Handshaking usually not required, but you can turn on Xon/Xoff if you desire.

- 2) Press **[Return]** on your Terminal keyboard. The main menu should appear. If the comm port is in the Host Mode, you must send the characters: **MSI9MSI9 [Return]** Make sure you have matched the Baud Rate the Host was using.

```

----- MSI 9000 - CellScale -----
- (c) 2006 Measurement Systems International -
-----

13:48:06                                01/02/06

(1) Channels/Calibration
(2) Communications
(3) Display
(4) Feature Locks/Passwords
(5) Product IDs
(6) Set Points
(7) System
(8) About...

Enter choice :
```

- 3) Select “Channels / Calibration” by pressing the **[1]** key. The Channel Setup menu appears.

```

***** Channel Setup *****

(1) Channel Calibration
(2) Data backup
(3) Filter (software)
(4) Channel Scanlist functions
(5) Motion Compensation (Accelerometer option required)
(6) Motion Detection
(7) Tare
(8) Total
(9) Units Lock
(a) Zero
(ESC) Exit
```

- 4) Press **[b]** to enter the Zero Setup Menu

```

***** Zero setup *****

(1) Choose the channel to change:      1-1
(2) Automatically zero at power up:    Disabled
(3) AZM (auto zero maintenance):      Enabled
(4) AZM range (0=1/2, 1-255):         1 d
(5) AZM time between checks:          1000 msec
(6) Current zero offset:               0. Kilograms
(ESC) Exit
```

- 5) Select the input channel with the **[1]** key. Channels in the channel list will appear in order.
- 6) Set the AZM range entry screen by pushing the **[4]** key.

```

Type the # of d for AZM range (0=1/2, 1-255): 3
```

- 7) Enter the number of ‘d’ for the AZM range with the number keys of the terminal. Note that entering ‘0’ causes the AZM range to be $\pm 0.5d$. Terminate the entry with a **[Return]**. In this example we’ll enter ‘3’ which gives a $\pm 3d$ AZM range.



***** Zero setup *****

(1)	Choose the channel to change:	1-1
(2)	Automatically zero at power up:	Disabled
(3)	AZM (auto zero maintenance):	Enabled
(4)	AZM range (0=1/2, 1-255):	3 d
(5)	AZM time between checks:	1000 msec
(6)	Current zero offset:	0. Kilograms
(ESC)	Exit	

- 8) Next choose the AZM timing screen by pushing [5]. This menu sets how often the CellScale will adjust zero within the AZM range. Entry is in milliseconds (1000ms = 1s).

Type # msec between AZM checks (50 - 10000): 1000

A good number for this is 1s (1000ms). Faster checks may cause slow changing weight to be zeroed out instead of being weighed. This is application dependent. Terminate the number entry with a return.

- 9) Push [ESC] to finish zero setup.

CALIBRATING PARTIALLY FILLED TANKS

The CellScale can calibrate partially filled tank scales using its large dead-load zeroing capability. First you must know the current weight on the scale. Write this number down. Second, calibrate the CellScale with the standard calibration routine, using the partially filled weight as zero, with some calibrated weight to establish the span. This can be a test weight added to the tank or a known weight quantity of product. The result of this calibration will read zero with the current weight in the tank. Finally, use the zero offset feature (see page 19) to enter the value of the known internal weight written down earlier.

A limitation of this technique is that the A/D reserves 20% of its counts to convert below calibration zero. If the tank is more than 20% filled the CellScale may not be able to go to zero before the A/D underranges. This can be fixed using direct manipulation of the DAC register. Contact MSI if this situation occurs for instructions on changing the DAC register.

MOTION DETECTION

Motion detection is provided to prevent totaling, taring and zeroing out weight that has not settled. Motion Detection preserves system accuracy at the expense of time. Legal-for-trade installations have set requirements for motion detection. In industrial settings the motion detection is programmable to fit the application. In applications where speed is more important than accuracy (such as overload warning systems) you can choose to disable motion altogether.

There are three menu items affecting Motion Detection: menu item 2 enables and disables motion detection for the given channel, menu item 3 sets the motion band range in 'd' (1/2 to 255d where 0=1/2), and menu item 4 which defines the time period the weight must remain in the motion band before the CellScale considers the weight steady.

- 1) Connect a terminal (or computer with a terminal program) to the CellScale Comm Port 1. Settings for your terminal program are: 9600 baud, 8 bit, 1 start bit, 1 stop bit, no parity, Handshaking usually not required, but you can turn on Xon/Xoff if you desire.
- 2) Send the CellScale a [Return] character. The main menu should appear. If the comm port is in the Host Mode, you must send the characters: ;MSI9MSI9 [Return] Make sure you have matched the Baud Rate the Host was using.

```

----- MSI 9000 - CellScale -----
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-----

13:48:06                                04/04/06

(1) Channels/Calibration
(2) Communications
(3) Display
(4) Feature Locks/Passwords
(5) Product IDs
(6) Set Points
(7) System
(8) About...
    
```

3) Select “Channels / Calibration” by pressing the [1] key. The Channel Setup menu appears.

```

***** Channel Setup *****

(1) Channel Calibration
(2) Data backup
(3) Filter (software)
(4) Channel Scanlist functions
(5) Motion Compensation (Accelerometer option required)
(6) Motion Detection
(7) Tare
(8) Total
(9) Units Lock
(a) Zero
(ESC) Exit
    
```

4) Press [6] to enter the Motion Detection Menu.

```

***** Motion Detection Setup *****

(1) Choose the channel to change:      1-1
(2) Motion detection:                  Enabled
(3) Motion detection band:             0
(4) Time period to detect motion:      1000 msec
(ESC) Exit
    
```

5) Select the input channel with the [1] key. Channels in the channel list will appear in order.

6) Enable or disable motion detection with the [2] key.

7) Set the motion band by pushing the [3] key.

```

Type motion band size in countbys (0=1/2, 1-255): 3
    
```

7) Enter the number of ‘d’ for the motion band range with the number keys of the terminal. Note that entering ‘0’ causes the motion band to be $\pm 0.5d$. Terminate the entry with a [Return]. In this example we’ll enter 3 which gives a $\pm 3d$ motion band.

```

***** Motion Detection Setup *****

(1) Choose the channel to change:      1-1
(2) Motion detection:                  Enabled
(3) Motion detection band:             3
(4) Time period to detect motion:      1000 msec
(ESC) Exit
    
```

8) Next choose the motion timing screen by pushing [4]. This menu sets the length of time the reading must be within the motion window before the CellScale considers the reading stable. Entry is in milliseconds (1000ms = 1s).



Type # msec in which to detect motion (50 - 10000): 1000

A good number for this is 1s (1000ms). Longer times will slow the response to keys such as tare or zero. Shorter times may allow tare or zero of a weight that is still not settled to the final reading. This is application dependent. Terminate the number entry by pressing **[Return]**.

- 9) Push **[ESC]** to finish motion detection setup.

CALIBRATION OF SLAVE CELLSCALE CHANNELS

It is recommended that slave CellScales used for channel 5 are calibrated independently before using them for channel 5. This can be done by using the terminal interface calibration routine shown in this section to calibrate the slave CellScale's input channels as if it were to be a standard CellScale. Follow the full calibration procedure for all slave channels. Then later, when converted to a slave CellScale, all the calibration constants will be passed to the master CellScale automatically.

The Slave CellScale cannot have channel 5-x in its scan list. Program the scan list with normal A/D channels 1-x to 4-x.

Never attempt to calibrate a slave CellScale from the master except for a "Redo" type of calibration. If you need to change capacity or resolution of a Slave CellScale channel, it must be done with a direct terminal connection to the slave CellScale. Doing an initial calibration from a Master CellScale or a 3750CS to a Slave CellScale will result in floating point errors. Standard "Redo" calibrations are fine from both the master CellScale or any connected 3750CS.

It is possible to perform a reset (initial) calibration of a slave CellScale system from the 3750CS. The Master CellScale must be turned off and communications reconfigured to turn the Slave CellScale back into a master. Then calibrate with the 3750CS. When finished return the communications setup to a Slave, turn on the Master and Calibrate it. This also requires changing the 3750CS communications settings at each step. All this is not necessary for recalibrations, all channels can be calibrated from the 3750CS without Network changes.



MOTION COMPENSATION OPTION CALIBRATION

MSI offers an advanced motion compensation option that uses accelerometers and angle sensing to correct weight reading while the scale is in motion. The intended use for this is improving the speed of crane scale applications. Other uses are possible but MSI should be contacted to discuss the application. Motion Compensation is limited to relatively low resolution systems (2500d or less) and accuracies achieved in motion are limited to about 1% depending on the dynamics and other variables. The Motion Compensation module must be precalibrated at MSI.

Because the dead load of the scale and any attachments contribute to the overall mass, these constants must be measured and accounted for. For convenience MSI provides two variables: 1) MSI Component Weight - This is the weight of the active portion of the scale and varies from design to design. On MSI supplied crane systems this weight is on the calibration tag and is identified as "Comp Wt". 2) User Component Weight - This is the weight of any permanently attached fittings that normally would be zeroed out. Examples include the weight of an Electromagnet and its chains and fittings, the weight of any rigging including shackles, webbing and chains. These weights must be input precisely for the system to function accurately. Use a .1% weighing system with resolution at least twice that of the Motion Compensated CellScale system. For example, if the resolution of the CellScale system is 20lb, then the User Component Weight should be to the nearest 10 lb.. Truck scales are usually not appropriate for determining the User Component Weight. MSI can provide high resolution crane scales for this purpose, on a rental basis.

Motion Compensation Setup and Calibration

- 1) From the Channels/Calibration Menu, push **[5]**. If the message appears that the option is not installed, then verify the option is installed and plugged in properly.

```

***** Channel Setup *****

(1)   Channel Calibration
(2)   Data backup
(3)   Filter (software)
(4)   Channel Scanlist functions
(5)   Motion Compensation (Accelerometer option required)
(6)   Motion Detection
(7)   Tare
(8)   Total
(9)   Units Lock
(a)   Zero
(ESC) Exit
    
```

```

***** Motion Compensation Setup *****

(1)   Choose the channel to change:      1-1
(2)   Motion/Angle compensation:        Motion, Side A up
(3)   Motion/Angle compensation mode:   Smart
(4)   MSI component weight:             292.   Pounds
(5)   User component weight:            6180.  Pounds
(6)   Setup/calibrate the accelerometer: Calibrated
(ESC) Exit
    
```

- 2) Motion compensated systems are usually one channel systems, so there is no need to change the channel. Verify the channel listed under menu item 1 is the proper scale channel to apply motion compensation to.
- 3) Use the [2] key to setup the mounting angle. This is determined by the physical mounting of the accelerometer. For MSI systems equipped with this option set:

MCS Crane Scales - Side D up	OMS Crane Scales - Side A
6260CS - Side D up	Contact MSI for custom arrangements

 For systems other than those mentioned, the standard procedure for motion compensation is to pick the side that give a positive 1g rating. This can be achieved through trial and error with this menu.

```

***** Motion Compensation Orientation *****

(1)   Side A is up
(2)   Side B is up
(3)   Side C is up
(4)   Side D is up
(5)   Side E is up
(6)   Side F is up
(7)   Disabled
(ESC) Exit

Current orientation setting:      Side A is up
Current gravity reading through side A: 1.01   g
Current side that is closest to up: Side A:
    
```

The example screen shows that the orientation of the accelerometer is correct (reads +1g). When the correct orientation has been achieved, push [ESC].

- 4) Next, the type of motion compensation is selected. For all loading applications, MSI recommends using the “Smart” setting. This introduces an advanced compensation algorithm developed for loading applications.



```

***** Motion Compensation Mode *****

(1)   Actual
(2)   Smart
(ESC) Exit

Current motion compensation mode:   Smart
Hardware FastStep mode:             Off
Hardware filter speed:              863
Hardware skip mode:                 On
Software filter:                    High
Hi end settling filter:              4 %
Lo end settling filter:              2 %
    
```

Use of the “Actual” setting should be limited to at sea applications where the whole system is in motion. The information set below is only programmable by MSI and is used to optimize motion algorithms. These parameters can be adjusted as needed by MSI technical personnel. Push [ESC] to return to the previous menu.

```

***** Motion Compensation Setup *****

(1)   Choose the channel to change:   1-1
(2)   Motion/Angle compensation:     Motion, Side A up
(3)   Motion/Angle compensation mode: Smart
(4)   MSI component weight:          292.   Pounds
(5)   User component weight:         6180.  Pounds
(6)   Setup/calibrate the accelerometer: Calibrated
(ESC) Exit
    
```

- 5) Next push [4] and enter the MSI component weight. This is the weight of the active part of the scale. It **cannot** be determined by weighing the scale. This is supplied on all MSI designed scales. For scales other than MSI designs contact us for information on how the MSI component weight can be determined.

```

Type the MSI component weight:          Pounds
    
```

Type in the weight then push [Return].

- 6) Next push [5] and enter the User component weight. This is the weight of all customer supplied dead load hanging on the scale. This weight should be entered in a resolution at least twice that of the CellScale system. This weight is best determined by weighing everything that will be zeroed out under the scale.

```

Type the User component weight:         Pounds
    
```

Type in the weight then push [Return].

This concludes the usual calibration of the Motion Compensation System.

Although step 6 is provided for calibration of the module, without proper test rigs and a controlled temperature calibration chamber, it is not feasible for the end user to calibrate the module. MSI will supply precalibrated modules in the event of a field failure.

```

***** Motion Compensation Setup *****

(1)   Choose the channel to change:   1-1
(2)   Motion/Angle compensation:     Motion, Side A up
(3)   Motion/Angle compensation mode: Smart
(4)   MSI component weight:          292.   Pounds
(5)   User component weight:         6180.  Pounds
(6)   Setup/calibrate the accelerometer: Calibrated
(ESC) Exit
    
```

UPDATING CELLSCALE FIRMWARE

The CellScale contains Flash memory that allows the firmware to be upgraded through the Comm Port. A “Boot Loader” program is used to load a new program file into the CellScale. MSI will upgrade and improve the CellScale feature set over time and provide program updates free of charge. Please see MSI’s web page (www.msiscalcs.com) to download the most current CellScale firmware. For users of the 3750CS, please check compatibility of CellScale firmware vs. 3750CS firmware. The 3750CS must have a ROM upgrade and cannot be upgraded via a terminal. Some firmware upgrades do not rewrite the cal memory, so using the backup now feature in the calibration menus will allow calibrations to be restored. See Section 3 - page 16 for details about storing and restoring calibration data prior to updating firmware.



This process completely destroys calibration and setups. Be prepared for a complete system setup and calibration of all A/D channels (unless you backed up calibration).

Using CellScale Bootloader

- 1) Set a terminal program to emulate an ASCII terminal.
- 2) Set the Baud rate to 9600 Baud, 8 data bits, 1 stop bit, and no parity, which are the default settings. If the serial settings have been altered for use in the host mode, you should set your terminal program to the same settings the host program used.
- 3) Set the data transfer protocol to ASCII.
- 4) Connect the Cellscale to the PC serial port.
- 5) Apply power to the Cellscale.
- 6) Press the [Return] key on your terminal keyboard. The Main Menu should appear. If it does not, the CellScale may be in Host Mode. If so, match the baud rate of your terminal with the host computer, and type: ;MSI9MSI9[Return]
- 7) From the main menu, Press [7] to bring up the system menu.
- 8) Select “Load New Application Software” by pressing [8]. A confirmation screen appears.

```
Ready to load new application!

Are you sure??
Type YES to complete this action.
Type NO  to abort   this action.
```

- 9) Type YES. This will bring up the Boot Loader Menu. The LEDs visible on the 9000 Front Panel (power LED on the 6260CS) will blink in a pattern of 5 blinks with a pause.

```
MSI Boot Loader Version 3.01

(1)    Update Application
(2)    Change Baud Rate
(ESC)  Start Application

Enter Command :
```

- 10) Choosing a faster baud rate will decrease the amount of time required to complete the update. However, baud rates above 38400 usually require a 5 wire serial cable (include RTS and CTS) and a terminal program that supports hardware handshaking. Push [2] to change baud rate.

- 12) A slow, monotonous flash pattern indicates a successful upgrade. A fast flash pattern indicates an error. If in error, repeat the process with a slower baud rate. If successful, the main boot load screen will reappear.

```
MSI Boot Loader Version 2.13

(1)   Update Application
(2)   Change Baud Rate
(ESC) Start Application

Enter Command :
```

- 13) Pressing **[ESC]** will begin the application.
- 14) After an application upload, the CellScale must perform a “RESET ALL”. Press **[Y]** to reset the CellScale.

```
Program update detected. To perform a RESET ALL, Press <Y>.
```

- 15) After the “RESET ALL” the application main menu will output to the terminal at 9600 baud. If you had increased your terminal baud rate, the menu will be garbage. Change your terminal back to 9600 baud. Pressing **[r]** will cause the menu to repaint on the screen properly.
- 16) Restore calibration data (See Section 3, page 17). Check and restore all system parameters as needed. RF Modem network parameters are not usually affected by this process, but should be checked.

STANDARD MODE

The 9000 CellScale is a versatile instrument that adapts to many industrial weighing systems. In Legal-for-Trade systems, certain features are limited in order to reduce the possibility of fraud. Setting the standard will setup the feature set to adapt to legal requirements.

Setting the Legal Standard Mode

- 1) From the Channels/Calibration Menu, push [b].

```

***** Channel Setup *****

(1) Channel Calibration
(2) Data backup
(3) Filter (software)
(4) Channel Scanlist functions
(5) Motion Compensation (Accelerometer option required)
(6) Motion Detection
(7) Tare
(8) Total
(9) Units Lock
(a) Zero
(b) Standard Mode: Industry
(c) 4 to 20mA
(ESC) Exit

```

```

***** Scale Standard Setup *****

(1) Industry
(2) NTEP
(3) OIML
(4) Metric (g, kg, metric tons)
(ESC) Exit

```

- 2) Select the desired scale standard.

Descriptions of standard modes:

[1] Industry – All functions and units are available. This is the default mode of the 9000 (and 6260CS, 9300, and 9260).

[2] NTEP – Choosing NTEP has the following effect: 1) The sealed switch must be pressed to modify any metrologically significant setting, 2) Multiple remote RF display devices are allowed, but only one device is allowed to zero, tare, or any other control function. This device is determined in the Communications Menu (page xxxx). See “Sealing the MSI-9000” on the following page for details on sealing the settings and calibrations.

[3] OIML – R76 sealed mode. Features not allowed by OIML R76 testing are locked out. R76 feature set is TBD. This setting is not yet operational, but choosing it will install the NTEP feature set with only Metric Units available (g, kg, metric tons).

[4] Metric – All features are enabled, except only Metric units are available (g, kg, Metric Tons).

- 3) Selecting NTEP or OIML for the first time will bring up the following screen:

```

***** Notice *****
* You must push the sealed *
* calibration switch on the*
* CellScale to continue.  *
*       Push now or       *
*                         *
*                         *
* (ESC) to exit           *
*****

```

Remove the seal screw (see figure 7-1). Using a non-metallic tool, gently press the pushbutton located

behind the hole. This enables menu access and calibration of all the metrologically significant parameters. Pressing the button stays in effect until the power is cycled.

SEALING THE MSI-9000 CELLSCALE

The 9000 CellScale is sealed with a standard lead-wire seal. The seal is used to prevent removal of the seal screw covering the calibration enable switch. The wire is passed through the seal screw and through two adjacent screws in the lid. Use seal wire with a maximum diameter of .040" (1mm). 20 Gauge or smaller wire is appropriate.

Once all channel parameters are set and calibrations completed replace the seal screw and tighten down securely to ensure a water proof seal.

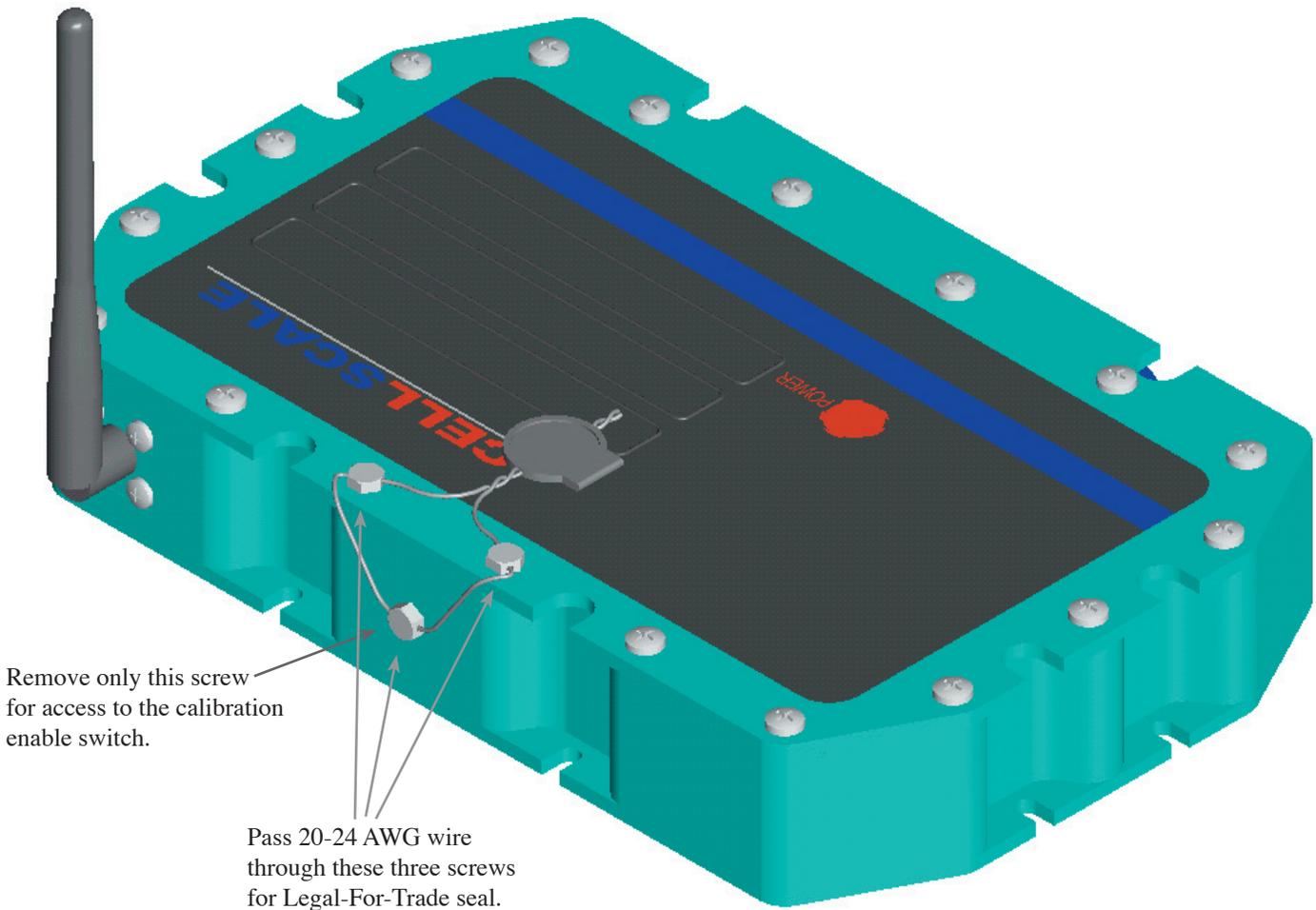


Figure 7-1

Sealing display devices (9750A and 3750CS) is not required because all metrologically significant features are in the 9000 device. The 3750CS does offer a sealing method to prevent calibration tampering in industrial settings. However use of the 3750CS for calibration still requires pressing the calibration enable switch on the 9000 when it is set into L-F-T modes. The 9750A offers password protection modes to prevent calibration tampering, but again, in L-F-T modes the calibration enable switch on the 9000 will have to be pressed, requiring breaking the seal at the 9000.



4-20mA OUTPUT OPTION

The 4-20mA Output Option provides a means to connect the CellScale to analog inputs found on PLCs and other industrial equipment. The option is available in single and dual output versions allowing one or two channels of the CellScale to drive the 4-20mA outputs.

The 4-20mA output requires a loop supply to ensure isolation. Appropriate loop supply range is 7.5 to 100V_{DC}. Actual required loop supply voltage is dependent on the receiving resistor. The converter uses 6.5V_{DC} from the loop. If a 250Ω resistor is required, at 20mA, the voltage across the 250Ω resistor is 5V. The minimum voltage required from the loop will be 5V + 6.5V + V_{wire} (the drop across the wiring which depends on gauge and length). For a 250Ω resistor a prudent minimum loop supply would be 11.5V. The most common industrial loop supply is 24V which should allow quite a range of loop receiving resistor values. If the CellScale is DC powered, the loop supply can share the positive input with the CellScale. The Loop Return line will float as necessary to output the desired current. Sharing loop power with the CellScale power would eliminate isolation and has to be evaluated in each installation.

Setup the 4-20mA Output Option

- 1) From the Channels/Calibration Menu, press [c].

```

***** Channel Setup *****

(1)   Channel Calibration
(2)   Data backup
(3)   Filter (software)
(4)   Channel Scanlist functions
(5)   Motion Compensation (Accelerometer option required)
(6)   Motion Detection
(7)   Tare
(8)   Total
(9)   Units Lock
(a)   Zero
(b)   Standard Mode: Industry
(c)   4 to 20mA
(ESC) Exit

```

The 4-20mA Setup menu appears.

```

***** 4 to 20mA Setup *****

(1)   4 to 20mA Device # 1
(2)   Installed: NO
(3)   Status: Enabled
(4)   Data from scan list position: 1
(5)   Data source mode : Gross
(6)   20mA = 10000.0000 Pounds
(7)   4mA = 0.0000 Pounds
(8)   Default output value = 4.000 mA
(9)   Test output value = 4.000 mA
(a)   Test output status: Disabled
(ESC) Exit

```

- 2) Select the 4-20mA output device by pressing [1]. Device #2 is only available with the Dual 4-20mA Output option.
- 3) If the Option is installed, ensure that menu choice [2] reads installed. If it reads “NO” press [2].
- 4) The 4-20mA Option can be enabled or disabled by pressing [3]. When disabled, you can still set up span parameters, but the output will be off.
- 5) The 4-20mA output can be driven from any channel in the scan list. Press [4] to select the scan list position. The 4-20mA can be driven by scale channels or math channels.

Use the Channel Scan List Setup sheet to select the proper channel for conversion to a 4-20mA output.

```
***** 4 to 20mA Setup *****
```

```
(1) 4 to 20mA Device # 1
(2) Installed: NO
(3) Status: Enabled
(4) Data from scan list position: 1
(5) Data source mode : Gross
(6) 20mA = 10000.0000 Pounds
(7) 4mA = 0.0000 Pounds
(8) Default output value = 4.000 mA
(9) Test output value = 4.000 mA
(a) Test output status: Disabled
(ESC) Exit
```

```
Type the scanList position to place this (1 - 32): 1
```

- 6) Input the desired scan list position (1-32) followed by a Return (Enter).
- 7) The 4-20mA output can respond to Gross weight or Net weight (which is equal to Gross weight when the tare value is zero). Which to use is dependent on the application. Press [5] to change the Data source mode between Gross and Net.
- 8) Set the weight equivalent to 20mA by pressing [6].

```
***** 4 to 20mA Setup *****
```

```
(1) 4 to 20mA Device # 1
(2) Installed: NO
(3) Status: Enabled
(4) Data from scan list position: 1
(5) Data source mode : Gross
(6) 20mA = 10000.0000 Pounds
(7) 4mA = 0.0000 Pounds
(8) Default output value = 4.000 mA
(9) Test output value = 4.000 mA
(a) Test output status: Disabled
(ESC) Exit
```

```
6
```

```
Enter a value (in Pounds      ) that = 20 mA :
```

- 9) Enter an in-span weight for the chosen scan list position that you want to be equal to 20mA. This can be any weight. Input the value then push return on your terminal.
- 10) Set the weight equivalent to 4mA by pressing [7]. Enter an in-span weight for the chosen scan list position that is lower than the 20mA input.

```
***** 4 to 20mA Setup *****
```

```
(1) 4 to 20mA Device # 1
(2) Installed: NO
(3) Status: Enabled
(4) Data from scan list position: 1
(5) Data source mode : Gross
(6) 20mA = 10000.0000 Pounds
(7) 4mA = 0.0000 Pounds
(8) Default output value = 4.000 mA
(9) Test output value = 4.000 mA
(a) Test output status: Disabled
(ESC) Exit
```

```
7
```

```
Enter a value (in Pounds      ) that = 4 mA :
```

- 11) Enter an in-span weight for the chosen scan list position that you want to be equal to 4mA. This can be any weight lower than the 20mA value but is usually set to zero. Input the value then push return on your terminal.



- 12) A default output setting is available. This output setting will be used if the scan list channel supplying the data for current conversion is unavailable. This can happen on a slave cellscale channel 5 if the RF communications is disconnected, or if the channel is made inactive. The default setting is usually set to the equivalent of zero which is 4mA. Set the desired default by pushing [8].

```

***** 4 to 20mA Setup *****

(1) 4 to 20mA Device # 1
(2) Installed: NO
(3) Status: Enabled
(4) Data from scan list position: 1
(5) Data source mode : Gross
(6) 20mA = 10000.0000 Pounds
(7) 4mA = 0.0000 Pounds
(8) Default output value = 4.000 mA
(9) Test output value = 4.000 mA
(a) Test output status: Disabled
(ESC) Exit

8

Enter default value in mA:

```

- 13) Enter a current setting from 4.000 to 20.000mA. Press Return or Enter on your terminal.

TESTING THE CURRENT OUTPUT

The CellScale provides a means to test the current output. This feature should be used with caution as it can cause set points on connected PLC's to trigger. While the test output is in use, the output value is fixed and is not modified by the input channel.

To Test the 4-20mA Output

- 1) Set the desired output value in mA by pressing [9] (from the 4-20mA Setup menu).

```

***** 4 to 20mA Setup *****

(1) 4 to 20mA Device # 1
(2) Installed: NO
(3) Status: Enabled
(4) Data from scan list position: 1
(5) Data source mode : Gross
(6) 20mA = 10000.0000 Pounds
(7) 4mA = 0.0000 Pounds
(8) Default output value = 4.000 mA
(9) Test output value = 4.000 mA
(a) Test output status: Disabled
(ESC) Exit

9

Enter test value in mA:

```

- 2) Enter a current setting from 4.000 to 20.000mA. Press Return or Enter on your terminal.
- 3) Turn on the output value by pressing [a]. The fixed output is applied when Enabled.
- 4) Vary the output value by repeating steps 1 and 2.
- 5) When finished, be sure to disable the output by pressing [a]. Confirm that the Test output status is "Disabled".

The 4-20mA output will not function if the Status is Disabled and/or the Test output status is Enabled.

4-20mA CONNECTOR LOCATION

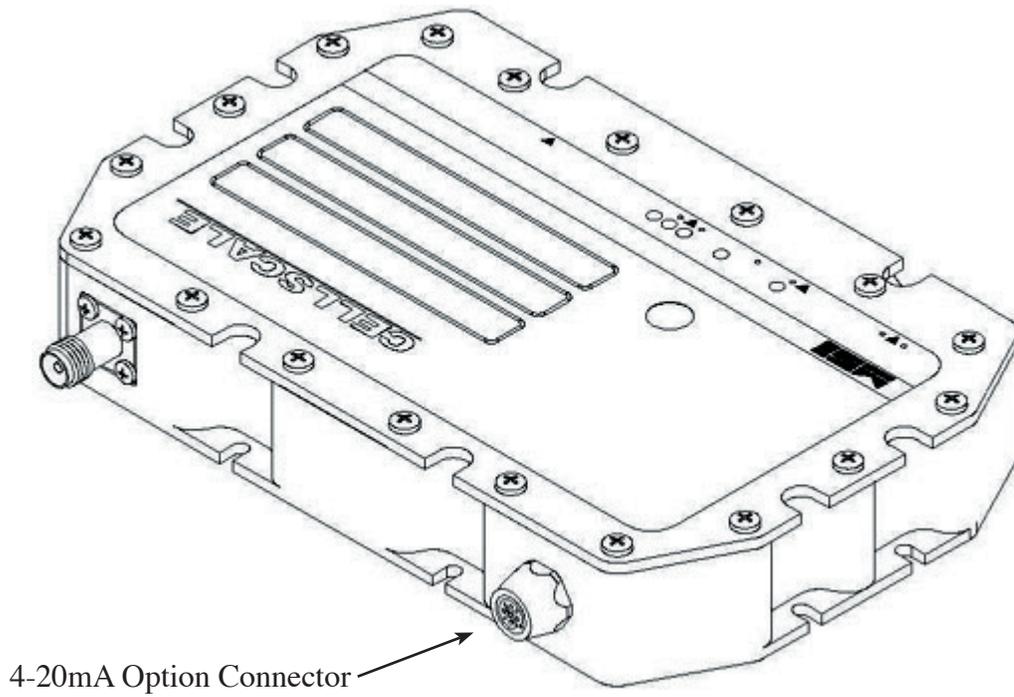
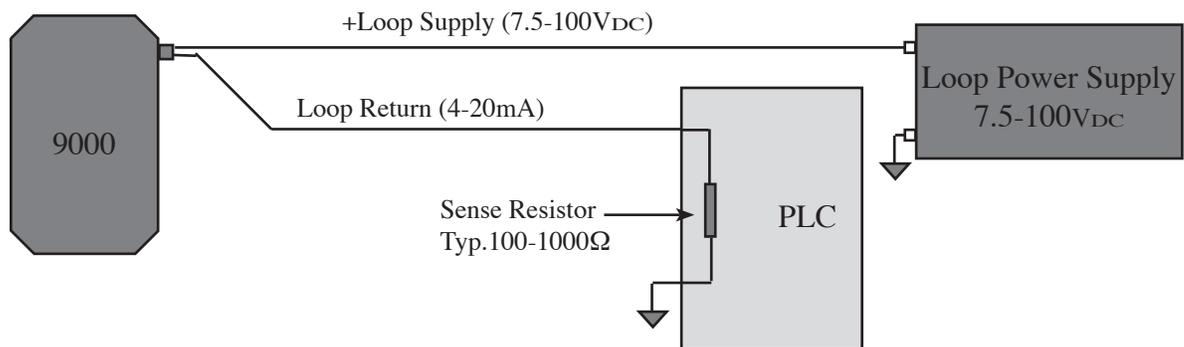


Figure 7-2

TYPICAL WIRING DIAGRAM



The Dual Output Option can share one loop supply or use a separate isolated supply if necessary.

Figure 7-3



SECTION 8 - HOST MODE

The CellScale can be controlled by a computer through the use of “Host Commands.” These commands are sent to the CellScale through the Comm Ports or via RF from a computer connected to a MSI 9020 CellModem. Using host commands allows the user to set up the CellScale remotely and query the scale at any time to get status, weight, or accumulated totals.

General Protocol

The MSI-9000 responds to ASCII commands that consist of a two letter mnemonic. Depending on the command, a 1 or 2 digit item selection (sub-code) may be required. Certain commands require user supplied data. Commands sent from a host computer can be chained together in any order. Commands are terminated by another command, by a semicolon (;), or by a return key (↵). Initialize the command parser by sending the semicolon (;) character when first connecting to the CellScale. It is necessary to end a multiple command string with the semicolon as a terminator. Variable length numeric data must be terminated by a semicolon or by another command. Variable length alphanumeric data must be terminated by a semicolon before adding additional commands. Commands are case insensitive. Some commands require a return (CR/LF) which is indicated with the symbol “↵”.



It is important that the final character sent to the 9000 is a semicolon (;).

“@” Commands Under Computer Control

The “@” commands also function under host computer control, however they act differently than standard computer commands. The “@” commands, when received by the CellScale, will cause the immediate transmission of the asked for data type out the Comm port (or RF modem acting as a virtual comm port). The “;” delimiter is usually not necessary unless the “@” commands are combined with the standard computer commands. The preferred way to get data from the CellScale is to use the “PLD” commands, set up a print string with all the @ codes desired, then use the “PED” commands to cause data transmissions. Once the print string is set up with the desired data, only the PED commands are necessary.

Description	Cmd	Command Suffix	Input examples	Output examples & comments *= a space or place holder
Reset the host parser	;	None	;	<i>This command can be used at any time to reset the command parser</i>
Select Active Channel	@nn	where “nn” is the channel list location 01-32	@05 @26	Selects Channel List location 5. All commands that are channel specific are directed to this Channel Selects location 26
Change to next channel w/ Labels	@+	None	@+	Switches to next channel and outputs SC number, LC# and LC Name
Change to previous channel w/ Labels	@-	None	@-	Switches to previous channel and outputs SC number, LC# and LC Name
Query for current scan list position	@?	None	@?	Outputs SC number, LC# and LC Name SC 1, CH 1-1, Name of Scale**** Name of scale up to 20 characters
Change to next channel (no Label)	@#	None	@#	Switches to next channel in scan list.
Change to previous channel (no Label)	@!	None	@!	Switches to previous channel in scan list.
Output an “@” sign	@@	None	@@	@ The CellScale uses the @ sign for specific embedded commands, this command allows the outputting of @.
Output Annunciators	@A	1=Battery Level 2=Center of Zero 3=Motion Status 4=OK to Total Status 5=Net./Gross Status 6=Channel Status	@A1 @A2 @A3 @A4 @A5 @A6	BAT1 =Bat >1% BAT2 =Bat >10% BAT3 =Bat >25% COZN =Not COZ COZY =COZ MTNN=No Motion MTNY=In Motion TTLN=Not OK to Total TTLY=OK to Total NET*=Net mode GRS*=Gross mode ACTN = Not Active ACTY = Active
Output Spaces	@B	# where “#” is the number of spaces from 1-255	@B100	100 spaces inserted in the string
Output ID Code	@C	1=ID and code # 2=Code # only	@C1	ID CODE **1 *14 Outputs the current ID number only.
Output Date	@D	1=ddmmyy 2=mm/dd/yy 3=dd/mm/yy 4=Day of Wk 5=ddmmyyyy 6=mm/dd/yyyy 7=dd/mm/yyyy 8=yyyymmdd (ISO)	@D1 @D2 @D3 @D4 @D5 @D6 @D7 @D8	30SEP02* 09/30/06 30/09/06 SATURDAY** 30SEP2006* 09/30/2006 30/09/2006 20060930
Output End-of-line String	@E	None	@E	Outputs End-of-line string. Up to 64 bytes.
Output Start-of-line String	@F	None	@F	Outputs Start-of-line string. Up to 64 bytes.
Output Horizontal Tabs	@H	# where “#” is the number of tabs from 1-255	@H10;	Outputs 10 horizontal tabs. Terminate with semicolon for less than 3 digits.



Description	Cmd	Command Suffix	Input examples	Output examples & <i>comments</i> *= a space or place holder
Output an RF modem ID	@I	# where “#” is the Registry position 1-16	@I1 @I2 @I5	125 ... RF ID of CellScale *15 ... RF ID of registry position 2 **8 ... RF ID of registry position 5
	@I17	Special case outputs CS Network and Address	@I17	NN,AAA ... RF Net and Address of CellScale
	@I18	Encoded Registry Output		

The @I18 command will cause CellScale to output a list of all the registered devices of a CellScale. The format is:

< Address,network#,type][id, status, type]...[id, status, type]>

The ‘<’ signals the start of the list. The ‘>’ marks the end of the list. The ‘[’ signals the start of a device info. The ‘]’ marks the end of a device info. Where id is the ID or address of a registered device in hex with padding 0. It ranges from 0 to FF. NetworkID is the network # in Hex of the wired connected device and the system. Where status is the status of the registered device in hex with padding 0. It ranges from 0 to FF. Where type is the type of registered device in hex with padding 0. It ranges from 0 to FF. The first [,] is the device that the host computer connected to. The following [,]..[,] are for the remote (slave) devices.

The type is defined as follows:

- 00 = CellScale Master
- 01 = CellScale Slave
- 02 = 9750A Handheld Indicator
- 03 = Host Computer connected via 9020 Modem
- 04 = 3750CS Indicator
- 05 = Direct connected CellScale Terminal
- 06 = CellScale Virtual Meter
- 07 = MSI9022
- 08 = Unknown device

The status is defined as follows:

- 00 = Modem not awake; no DSR.
- 01 = No network, no RF DCD.
- 02 = No Target, No high level communication yet.
- 03 to 10 = weak RF signal.
- 11 to 14 = normal signal

For example:

<[02,03,00][7B,11,04][5D,02,01]>

The first [] is the master CellScale (type 00) with a My address of 02, transmitting on Network 03;

The second [] is a remote 3750CS (type 04) with a My address of 123 (7Bh) and has a signal strength of 11.

The third [] is a Slave CellScale (type 01) with an address of 93 (5Dh), status 01 means the slave is either turned off, or out of range.

Description	Cmd	Command Suffix	Input examples	Output examples & <i>comments</i> *= a space or place holder
Output Bar Code String	@K	1= Bar Code String 1 2= Bar Code String 2 3= Bar Code String 3 4= Bar Code String 4 5= Bar Code String 1 <i>in fixed 64 Character field</i> 6= Bar Code String 2 <i>in fixed 64 Character field</i> 7= Bar Code String 3 <i>in fixed 64 Character field</i> 8= Bar Code String 4 <i>in fixed 64 Character field</i>	@K1	<i>Output Bar Code data string 1 This command is used to embed bar code string data in print/output strings.</i>

Description	Cmd	Command Suffix	Input examples	Output examples & comments *= a space or place holder
Output ID String	@L	1=ID String 1 2=ID String 2	@L1 @L2	String 1 from the current ID. ≤20 Bytes. String 2 from the current ID. ≤20 Bytes.
Output a scale mode	@M	1=Current 2=Gross 3=Net 4=Tare 5=Total 6=# Totals 7=Total, #Ttls 8=reserved 9=Last Total %=	@M1 @M2 @M3 @M4 @M5 @M6 @M7 @M9 @M%	GROSS* or NET GROSS* NET*** TARE** TOTAL* T*CNT* TOTAL*T*CNT GROSS+ or NET+ %G-CAP
Output Name	@N	1=Current Channel Name 2=Current ID Name 3=Current Set Point 4=Scan List Position 5=Channel Number	@N1 @N2 @N3 @N4 @N5	SCALE PLATFORM 2 APPLES** <i>always 8 characters</i> WARNING1** <i>always 8 characters</i> SC 21 <i>always 5 characters</i> CH 1-1 <i>always 6 characters</i>
Output Comm Port Data String	@P	1-5	@P1	Output Comm Port 1's data string <i>This command is used to embed print strings from one comm port to another. Do not embed a print string inside itself.</i>
Output Set Point Parameters	@S	01-32	@S01	Outputs ~1000 bytes of formatted data describing all set point parameters
Output Time	@T	1=HH:MM AM/PM 2=HH:MM:SS AM/PM 3=HH:MM 4=HH:MM:SS	@T1 @T2 @T3 @T4	04:22*PM 04:22:35*PM 16:22 16:22:35
Output Current units	@U	None	@U	LB** <i>pounds</i> OZ** <i>ounces</i> KG** <i>kilograms</i> G*** <i>grams</i> TON* <i>Short Tons</i> DAN* <i>dekanewtons</i> MTON* <i>Metric Tons</i>
Output Weight (Value only)	@V	1=current weight 2=gross 3=net 4=tare 5=total 6=# of totals 7= total, # of totals 8=reserved 9=last totaled weight %= %of capacity	@V1 @V2 @V3 @V4 @V5 @V6 @V7 @V9 @V%	**20.002 <i>Length: 8, fixed. Leading zeros suppressed</i> **205.08 <i>Length: 8, fixed. Leading zeros suppressed</i> *1188.50 <i>Length: 8, fixed. Leading zeros suppressed</i> ****5000 <i>Length: 8, fixed. Leading zeros suppressed</i> *432534.85 <i>Length: 10, fixed. Leading zeros suppressed</i> 12345 <i>Length: 5, fixed. Leading zeros suppressed</i> *432534.85,12345 <i>Length: 16, fixed. Leading zeros suppressed</i> **200.05 <i>Length: 8, fixed. Leading zeros suppressed</i> ***31.04 <i>Length: 8, fixed. Leading zeros suppressed</i>



Description	Cmd	Command Suffix	Input examples	Output examples & comments *= a space or place holder
Output Weight Value and mode	@W	1=current weight	@W1	**20.002*LB***GROSS* <i>Length: 20, fixed. Leading zeros suppressed</i>
		2=gross	@W2	**205.08*KG***GROSS* <i>Length: 20, fixed. Leading zeros suppressed</i>
		3=net	@W3	*1188.50*G****NET*** <i>Length: 20, fixed. Leading zeros suppressed</i>
		4=tare	@W4	*****5000*TNE*TARE** <i>Length: 20, fixed. Leading zeros suppressed</i>
		5=total	@W5	*432534.85*KG***TOTAL* <i>Length: 22, fixed. Leading zeros suppressed</i>
		6=# of totals	@W6	12345*T*CNT* <i>Length: 12, fixed. Leading zeros suppressed</i>
		7= total, # of totals	@W7	*432534.85*KG***TOTAL,12345*T*CNT* <i>Length: 34, fixed. Leading zeros suppressed</i>
		8=reserved		
		9=last totaled weight	@W9	**200.05*KG***GROSS+*or NET+ in NetMode <i>Length: 20, fixed. Leading zeros suppressed</i>
	%= Per Cent of Capacity	@W%	***31.04*%****G-CAP* or N-CAP in Net Mode <i>Length: 20, fixed. Leading zeros suppressed</i>	
Output a statistics value	@X	1=Average weight	@X1	**13.350
		2=Minimum	@X2	***3.200
		3=Maximum	@X3	**16.650
		4=Standard Deviation	@X4	***2.392
		5=Coeff of Variance	@X5	***32.50
		6=Grand Total	@X6	4263285.55
		7=Grand Average	@X7	*****52.50
		8=# of Grand Totals	@X8	*123434
Output a statistics value and mode	@Y	1=Average weight	@Y1	**13.350*LB***AVG***
		2=Minimum	@Y2	***3.200*LB***MIN***
		3=Maximum	@Y3	**16.650*LB***MAX***
		4=Standard Deviation	@Y4	***2.392*LB***STDDEV
		5=Coeff of Variance	@Y5	***32.50*LB***CO-VAR
		6=Grand Total	@Y6	4263285.55*LB***G-TOTL
		7=Grand Average	@Y7	*****52.50*LB***G-AVG*
		8=# of Grand Totals	@Y8	*123434*G-CNT*
Output All ID Statistics and grand statistics	@Z	none	@Z	<i>Outputs formatted data of all statistics for valid product IDs. Parameters include totals, number of samples, average, min, max, std dev, etc. for each product ID, and grand total with statistics for all product IDs combined.</i>

Typical @Z Output

1st Product ID Printout	2nd Product ID Printout	...after final ID, Grand Total printout
<pre> Product ID number: 1 Product ID name: Product ID ch-sub: Ch 1-1 5 T CNT 130.0 LB TOTAL 26.0 LB AVG 10.0 LB MIN 8 50.0 LB MAX 15.2 LB STDDEV 58.33 % CO.VAR </pre>	<pre> Product ID number: 2 Product ID name: Product ID ch-sub: Ch 1-2 0 T CNT 0.00 MTON TOTAL 0.00 MTON AVG 0.00 MTON MIN 0.00 MTON MAX 0.00 MTON STDDEV 0.00 % CO.VAR </pre>	<pre> 5 G-CNT 130.0 LB G-TOTL 26.0 LB G-AVG </pre>

Description	Cmd	Command Suffix	Input examples	Output examples & <i>comments</i> *= a space or place holder
Auto Off	AO	1=Disabled 2=10 Min. 3=30 Min. 4=1 Hour 5=2 Hours 6=4 Hours 7=8 Hours 8=24 Hours	AO1 AO4	<i>Auto off disabled</i> <i>Unit powers off after 1 hour of inactivity</i>
Auto Off Timer Reset Functions	AF	10=N on Load 11=Y on Load 20=N on Motion 21=Y on Motion 30=N on Remote activity 31=Y on Remote activity 40=N on Com1 activity 41=Y on Com1 activity 50=N on Com2 activity 51=Y on Com2 activity 60=N on Button press 61=Y on Button press	AF10 AF20 AF31 AF41 AF50 AF60	<Load change does not reset timer> <Motion does not reset timer> <Remote com resets timer> <Serial com1 resets timer> <Serial com2 does not reset timer> <Button pres does not reset timer>
Calibration Query	CAL	?	CAL?	SC nn, CH n-n, ccccccc x pppppppp uuuu, mm/dd/yyyy↵ Where: nn = Scanlist Position Number n-n = Channel-SubChannel cccccccc = Capacity pppppppp = Countby (d) mm/dd/777 = Cal Date
Set Date	DD	MM/DD/YYYY	DD04/22/2006	<i>Sets date to 22-April-2006</i>
Set Time	DT	HH:MM:SS	DT18:34:43	<i>Sets time to 6:34:43 PM. Time must be entered in 24 hour (military) mode.</i>
Set Day of Week <i>This command is no longer supported as of SW version 1-23 and above. In these versions, the day of the week is automatically calculated.</i>	DW	1=Sunday 2=Monday 3=Tuesday 4=Wednesday 5=Thursday 6=Friday 7=Saturday	DW7	<i>Sets the day of week to Saturday</i>



Description	Cmd	Command Suffix	Input examples	Output examples & comments * = a space or place holder
Total Rise Above Threshold (% of capacity)	EA	# Where # = 1-100	EA2	Sets rise above threshold to 2% of capacity. This must be set higher than the drop below threshold.
Total Drop Below Threshold (% of capacity)	EB	# Where # = 1-100	EA1	Sets drop below threshold to 1% of capacity. This must be set lower than the rise above threshold. 10% is default.
Time the scale must be out of motion before auto-totalling	ED	# Where “#” is 00-10000 expressed in milliseconds. 0 ms is the default value.	ED1000	Delays 1 second (1000ms) before auto-totalling.
			ED50	Delays 50ms before auto-totalling.
Total Mode	EM	1=Disabled 2=Auto load 3=Auto normal 4=Auto peak 5=Not implemented 6=On command 7=Load/drop	EM2	Set Auto-Total Auto load mode
Motion Check before Total	ET	0=Disabled 1=Enabled	ET0	Turns off Motion Check
			ET1	Turns on Motion Check (Default)
Software Filter	FL	1=Disabled 2=Low Filter 3=High Filter	FL1	Sets Software Filter off. Digital filter still active
ID Code Increment/Decrement	ID	1=Next ID 2=Previous ID	ID1	Sets the active channel to the next available ID.
ID Name Change	INC	***** Where * = 1-8 characters	INCApples;	Change ID name to Apples. If string is less than 8 characters, terminate with a return or a semicolon.
ID Name Find	INF	***** Where * = 1-8 characters	INFPears;	Find an ID named “Pears” and switch the active channel to this ID. If the ID does not exist, a new one is created.
ID String 1	IS1	***... Where * = 1-20 characters	IS1@D1@T1 @N@E;	String outputs date, time, ID name, and the end-of-line string. Use any “@” codes.
ID String 2	IS2	***... Where * = 1-20 characters	IS2@W1 @E;	String outputs current weight, and the end-of-line string.
Keyboard Function Emulate	KF	01=Power 02=Zero 03=Gross 04=Net 05=Tare 06=Total 07= 08=Clear Last Total 09=Clear Ttl crnt ID 10=Clear all Totals 11=Print 12=Peak Hold On 13=Peak Hold Off	KF02 KF03	Zero the active channel Force Gross Mode
			KF05	Action of the Tare function is dependent on the Tare mode setting.
				Note that this table shows default values. The action of the KF functions can be changed/overridden by making changes on the CellScale terminal screen (Communications Menu).
Channel Name Change	LN	ssss... where s is up to 20 characters	LNPLATTER #2	Changes name to PLATTER #5 Name is up to 20 characters. If less than 20, terminate with semicolon or carriage return.
Channel Status	LS	1 = inactive 2 = active	LS1	Sets current channel in-active.
			LS2	Sets current channel active. Channels must be active to convert weight.

Description	Cmd	Command Suffix	Input examples	Output examples & comments *= a space or place holder
Motion Compensation Algorithm <i>Motion Comp Option</i>	MCA	1=Actual 2=Smart	MCA1 MCA2	<i>Actual lets user control A/D parameters</i> <i>Smart matches A/D & accelerometer for best performance</i>
Motion Compensation High End Filter	MCH	# Where “#” is 0-100% (of capacity, 10% is default value)	MCH10;	<i>Set High end filter to 10% of capacity.</i> <i>Controls how quickly a motion compensated weight will settle on a weight.</i>
Motion Compensation Low End Filter	MCL	# Where “#” is 0-100 (% of capacity)	MCL8;	<i>Set Low end filter to 8% of capacity. Controls how quickly a motion compensated weight will return to zero after a weight is removed.</i>
MSI Component Weight	MCM	# (70lb default) Where “#” is the component weight in calibration units.	MCM70;	<i>Sets component weight to 70. This is the dead load weight of the load cell. This value cannot be measured. Use supplied values from MSI only.</i>
Motion Comp Sensor Orientation	MCO	0=M/C disabled 1=Side A is up 2=Side B is up 3=Side C is up 4=Side D is up 5=Side E is up 6=Side F is up	MCO0 MCO2	<i>Motion Comp disabled (default)</i> <i>Motion sensor side b is up.</i> <i>Contact factory for help in determining the proper sensor orientation.</i> <i>Note that “O” is the letter “oh”, not zero.</i>
User Component Weight	MCU	# Where “#” is the user component weight in calibration units.	MCM5000;	<i>Sets user component weight to 5000. This is the dead load weight of the weight assembly not including the load cell. This value must be accurately weighed. For example this is the weight of a magnet and its chains hanging from a motion comp'd load cell.</i>
Motion Detection	MD	0=Disabled 1=Enabled	MD1	<i>Enabled Motion Detection. Scale will not tare or zero or total if weight is not settled.</i>
Motion Detection Band	MDB	# Where “#” is 0-255 d	MDB0; MDB10;	<i>Set motion detection window to ±0.5d.</i> <i>Set motion detection window to ±10d.</i>
Motion Detection frequency	MDT	50...10000ms 1000 is default	MDT1000	<i>Sets time for no motion before clearing the motion flag. Rounded to the nearest 50ms.</i>
Message a 9750 Remote	MSG	###*text; Where “###” is the remote unit address (0-255), *, then text up to 160 characters followed by a semicolon (;)	MSG57*This is a test message to unit 57;	<i>Sends a text message to the remote unit specified. Use for operator prompts and guides. The remote must already be on the same network, and you must know the address of the remote.</i>
Toggle Power On/Off	O	N = Power On F = Power Off	ON OF	<i>If the CellScale is setup to allow remote power down and/or power up, this command will cycle power.</i>



Description	Cmd	Command Suffix	Input examples	Output examples & <i>comments</i> * = a space or place holder
Set Print Control Mode	PC	# # <i>Where the first # is for Comm Ports 1-5, and the 2nd # sets the mode: #1 = Continuous Output #2 = On Command #3 = On CTS #4 = On Change #5 = On Load #6 = On Set point #7 = On Total</i>	PC31 PC55	<i>Comm Port 3 set to continuous output</i> <i>Comm Port 5 prints on load.</i>
Execute Data Print String	PED	1=CommPort1 2=CommPort2 3=CommPort3 (RF) 4=CommPort4 (RF) 5=CommPort5 (RF)	PED3	<i>The data string preprogrammed for CommPort 3 (virtual comm port at a remote RF modem) will interpret all @ codes and output upon receiving this command. The output commands (see POE) differ only in that the @ codes are not interpreted and are just printed as is.</i>

Description	Cmd	Command Suffix	Input examples	Output examples & comments *= a space or place holder
Execute End-of-line string	PEE	1=CommPort1 2=CommPort2 3=CommPort3 (RF) 4=CommPort4 (RF) 5=CommPort5 (RF)	PEE3	<i>The end-of-line string preprogrammed for CommPort 3 (virtual comm port at a remote RF modem) will interpret all @ codes and output upon receiving this command.</i>
Execute Start-of-line string	PES	1=CommPort1 2=CommPort2 3=CommPort3 (RF) 4=CommPort4 (RF) 5=CommPort5 (RF)	PES3	<i>The start-of-line string preprogrammed for CommPort 3 (virtual comm port at a remote RF modem) will interpret all @ codes and output upon receiving this command.</i>
Set Continuous Output Interval	PI	## <i>Where the first # is for Comm Ports 1-5, and the 2nd # sets the interval in msec.:</i>	PI35000 PI11000	<i>Comm Port 3 outputs every 5 seconds. Comm Port 1 outputs 1 per second. 0 = once 100-10000 ms rounded out to the nearest 50ms</i>
Load Data String	PLD	1=CommPort1 2=CommPort2 3=CommPort3 (RF) 4=CommPort4 (RF) 5=CommPort5 (RF)	PLD1This is a test of a print string;	<i>Enter up to 512 characters (including @ codes) into the print string. Terminate with a semicolon.</i>
Load End-of-line string	PLE	1=CommPort1 2=CommPort2 3=CommPort3 (RF) 4=CommPort4 (RF) 5=CommPort5 (RF)	PLE<cr> <lf>;	<i>Enter up to 64 characters (including @ codes) into the end-of-line string. Terminate with a semicolon. Typically used for carriage return-line feed.</i>
Load Start-of-line String	PLS	1=CommPort1 2=CommPort2 3=CommPort3 (RF) 4=CommPort4 (RF) 5=CommPort5 (RF)	PLS3<stx> MSI CellScale;	<i>Enter up to 64 characters (including @ codes) into the start-of-line string. Terminate with a semicolon. This example outputs a stx character and the words "MSI CellScale".</i>
Output Data String	POD	1=CommPort1 2=CommPort2 3=CommPort3 (RF) 4=CommPort4 (RF) 5=CommPort5 (RF)	POD1	<i>The data for comm port 1 will output as programmed. Any enclosed @ codes are not interpreted.</i>
Output End-of-line string	POE	1=CommPort1 2=CommPort2 3=CommPort3 (RF) 4=CommPort4 (RF) 5=CommPort5 (RF)	POE3	<i>The end-of-line string for comm port 3 will output as programmed. Any enclosed @ codes are not interpreted.</i>
Output Start-of-line String	POS	1=CommPort1 2=CommPort2 3=CommPort3 (RF) 4=CommPort4 (RF) 5=CommPort5 (RF)	POS4	<i>The start-of-line string for comm port 4 will output as programmed. Any enclosed @ codes are not interpreted.</i>
Set Point # to Configure	S	## <i>Where "##" is a set point from 1-32</i>	S1; S24	<i>Setup Set Point 1. Setup Set Point 24</i>
Set Point Output Action	SA	p/t/a-n <i>where "p" =a-j, position in SP output list, and "t" =0-8, output type per this list: 0=reserved 1=Term. Dialog Box 2=String to com 1 3=String to com 2 4=String to com 3 5=On-Board relay 1 6=On-Board relay 2 7=On-Board relay 3 8=External relay</i>	SAA/1 SAA/5 SAC/6 SAD/8/32-2	<i>Set Point output position a will cause a terminal dialog box. Position A will also close on board relay 1. You can add multiple actions to any set point output action position. Position C will close on board relay 2 If you choose 8 then the relay address must be added in the form /aaa-nnn where "aaa" is a relay board address and "nnn is the sub-relay address.</i>



Description	Cmd	Command Suffix	Input examples	Output examples & comments *= a space or place holder
Set Point Check / Test	SC	0 = Released 1 = Enabled	S1; S24	<i>Set Point actions test</i>
Set Point Delay	SDL	# Where “#” is equal to delay time in milliseconds (0-10000).	SDL1000;	<i>Delay time is set to 1 second (1000ms).</i>
Set Point Dead Zone	SDZ	# Where “#” is equal to required dead zone in current units.	SDZ100;	<i>The dead zone is set up for 100 lb. (or kg etc.)</i>
Set Point Individual Enable	SE	0=Disabled 1=Enabled	SE1	<i>Current Set Point is enabled (Master must also be enabled for set point to function)</i>
Set Point Clear the Latch	SLC	# Where “#” is 0-32	SLC0 SLC4	<i>Clear all latched set points Clear latch on Set Point 4</i>
Set Point Latch On/Off	SLE	0=Disabled 1=Enabled	SLE1	<i>Current Set Point Latch function is enabled</i>
Set Point Master On/Off	SM	0=Disabled 1=Enabled	SM0 SM1	<i>All set points are disabled All individually enabled SPs are enabled</i>
Set Point Name	SN	***** Where “*” = 1-8 characters	SNHiThere;	<i>Current set point name is changed to “HiThere” Terminate less than 8 characters with a semicolon.</i>
Set Point Operator #1	SOP1	0=None 1=Greater than 2=Greater than or eq. 3=Less than 4=Less than or equal	SOP0 SOP1 SOP2 SOP3 SOP4	<i>Set Point is inoperative Trigger when input value exceeds SP value Trigger when input value is equal or greater Trigger when input value is less than SP value Trigger when input value is equal or less</i>
Set Point Operator #2	SOP2	0=None 1=Greater than 2=Greater than or eq. 3=Less than 4=Less than or equal	SOP0 SOP1 SOP2 SOP3 SOP4	<i>Set Point 2nd threshold is inoperative Trigger when input value exceeds SP value Trigger when input value is equal or greater Trigger when input value is less than SP value Trigger when input value is equal or less</i>
Set Point Operator Relationship	SOPR	0=None 1=Boolean AND 2=Boolean OR	SOPR0; SPI9; SPI30	<i>2nd threshold ignored Both SP conditions must be true for trigger Either SP condition if true causes trigger</i>
Set Point Input position in Scan List	SPI	## Where “##” is a input scan list position from 1-32	SPI1; SPI9; SPI30	<i>Set Point uses scan list input channel #1 Set Point uses scan list input channel #9 Set Point uses scan list input channel #30</i>
Set Point Output position in SP Out List	SPO	## Where “##” is a SP Output list position from 1-32	SPO1; SPO10 SPO30	<i>Triggered SP uses Output list position 1 Triggered SP uses Output list position 10 Triggered SP uses Output list position 30</i>
Set Point Pre-act	SPR	# Where “#” is equal to required Pre-act in current units.	SPR100;	<i>The preact value is 100 lb. (or kg etc.)</i>
Set Point Post-act	SPS	# Where “#” is equal to required Post-act in current units.	SPR50;	<i>The preact value is 50 lb. (or kg etc.). Do not program a value for Pre-act and Post-act as they would cancel each other out.</i>
Set Point Print String	SS	Of _{text} = Set point Off string On _{text} = Set point On string	SSOFIN TOLERANCE; SSONOUT OF TOLERANCE;	<i>If less than 20 characters terminate with a semicolon.</i>
Set Point Value Type #1	ST1	1=Gross 2=Net/Gross 3=Total 4=nTotals	ST11 ST12 ST13 ST14	<i>Set Point threshold 1 compare to gross wgt Set Point compares to gross or net wgt Set Point compares to the total wgt Set Point compares to number of totals</i>

Description	Cmd	Command Suffix	Input examples	Output examples & comments *= a space or place holder
Set Point Value Type #2	ST2	1=Gross 2=Net/Gross 3=Total 4=nTotals	ST21 ST22 ST23 ST24	<i>Set Point threshold 2 compare to gross wgt</i> <i>Set Point compares to gross or net wgt</i> <i>Set Point compares to the total wgt</i> <i>Set Point compares to number of totals</i>
Set Point Threshold Value #1	SV1	# Where “#” is = to value in current units.	SV11000;	<i>Value 1 is 1000 lb. (or kg etc.)</i>
Set Point Threshold Value #2	SV2	# Where “#” is = to value in current units.	SV21500;	<i>Value 2 is 1500 lb.</i>
Tare Auto Clear On/Off	TC	0=Disabled 1=Enabled	TC1	<i>When enabled, anytime a net weight is ≤ 0 tare value is cleared and the scale returns to gross.</i>
Tare Motion Check On/Off	TM	0=Disabled 1=Enabled	TM1	<i>When enabled, weight must be out of motion before the tare function can occur.</i>
Universal Tare On/Off	TU	0=Disabled 1=Enabled	TU1	<i>Enables Universal tare. All IDs on a given input channel share the same tare value.</i>
Tare Value	TV	# Where “#” is equal to required Value in current units.	TV500;	<i>Tare Value is 500 lb. (kg, etc.). Tare value must be \leq capacity of the input channel. See KF5 for auto tare.</i>
Units Mode	UM	1=Lower Case 2=Upper Case	UM1 UM2	<i>Print units in lower case (i.e. “lb.”, “kg”)</i> <i>Print units in upper case (i.e. “LB”, “KG”)</i>
Change Units	UN	1=Pounds 2=Kilograms 3=Tons 4=Metric tons (tne) 5=Ounces 6=Grams 7=DekaNewtons	UN2	<i>Change units to kilograms.</i> <i>Note: Depending on capacity, some units cannot be used.</i>
Auto-Zero Maintenance On/Off	ZA	0=Disabled 1=Enabled	ZA1	<i>Enables AZM. MSI recommends that AZM is enabled.</i>
Zero Offset	ZO	# Where “#” is equal to required Value in current units.	ZO120;	<i>Sets a 120 lb. (kg, etc.) offset into the scale. When the scale is zeroed it will return to 120 instead of zero.</i>
Zero Automatically at Power up	ZP	0=Disabled 1=Enabled	ZP1	<i>Causes the scale to zero any load automatically when the system is powered up.</i>
AZM Range	ZR	# Where “#” = \pm range in d of AZM	ZR3	<i>Sets the AZM range to ± 3 scale divisions.</i>
AZM Frequency	ZT	# Where “#” is 50-10000ms	ZT1000;	<i>AZM is checked every 1s (1000ms).</i>



Host Mode Calibration Commands

The following commands allow the CellScale to be calibrated from a host. The commands must be followed in order.

Description	Cmd	Command Suffix	Input examples	Output examples & comments *= a space or place holder
Start Calibration	CAL	# Where “#” is = to scanlist position.	CAL1↵ CAL8↵	Calibrate channel at scanlist position 1 Calibrate channel at scanlist position 8
Calibration Units	CU	1 = Pounds 2 = Kilograms 3 = Tons 4 = Metric Tons 5 = Ounces 6 = Grams 7 = Dekka-Newtons 8..16 = Future ? = Help query.	CU2↵	Calibrate in kg Use multiple ? to loop through units.
Calibration Capacity	CAP	# Where “#” is = to capacity in cal units.	CAP25000↵	Sets the capacity to 25000 units.
Calibration Count-by (d)	CB	# Where “#” is = to allowed resolution position. Use ? for help query.	CB3↵ CB?↵	Set county to 3rd allowed choice Use ? to loop through allowed choices Ex: Host types: C/S responds CB? CB1 = 0.1 LBS CB? CB2 = 0.2 LBS CB? CB3 = 0.5 LBS etc.
Calibration Zero	CZ	None	CZ↵	CZ :OK Unload the scale and then enter this command. Wait for the CellScale to respond with an “OK” (appx 4s).
Calibration Weight	CW	# Where “#” is = to the applied calibration weight.	CW10000↵ CW20000↵ CW200↵	10000 lb. (or kg, etc.) cal weight 20000 lb. test weight 200 lb. test weight Weights can be entered in any order. At least one cal weight is required. Up to 9 are allowed. Apply the weight to the scale before sending the command.
Calibration Save and Exit	CS	None	CS↵	Terminate the cal sequence and save parameters. CellScale responds with a “CAL:OK” or “CAL:ERR”.
Calibration Exit without saving	CX	None	CX↵	Terminate the cal sequence without saving. CellScale responds with a “CAL:ERR”.

SMA Level 1 Protocol

This document outlines commands currently defined in the Scale Manufacturers Association (SMA) Standard Scale Serial Communication Level 1 Protocol currently supported by the MSI9000 CellScale. The CellScale must be setup with the Terminal Interface program to respond to SMA commands.

Note: all SMA style inputs and outputs are preceded by a line feed (0x0A) and followed by a carriage return (0x0D).

Description	Cmd	Input examples	Output examples & comments *= a space or place holder
Abort Current Command	ESC	[ESC]	The command parsing process will be restarted.
Send 1st line of "About" data.	A	A	SMA:2/1.0 SMA compliance level 2 / revision 1.0
Send nth line of "About" data.	B	B	MFG:Measurement Systems Int'l MOD:MSI9000 CellScale REV: 1-05 SN :Not Displayed OP1:Version built on 05/11/06 OP2:Version built at 08:21:30 END: ? ? <i>Repetitive 'B' commands will send out consecutive lines of 'about' data. After all lines are output, further 'B' commands will display question marks. Reset the process by sending another 'A' command.</i>
Perform Internal Diagnostics	D	D	4 ascii characters are output between the line feed and carriage return. A letter indicates a failure. A space indicates a success. 1st: 'R' = RAM/ROM error 2nd: 'E' = EEPROM error 3rd: 'C' = Calibration error 4th: = Not yet defined
Output Weight	W	W	1GM 10050lb 18 ascii characters are output between the line feed and carriage return. They are defined below. A space in any status position indicates normal. <srnmfxxxxxxxxuuu> <m = motion status M = motion <s = scale status Z = Center of zero <f = future status O = Over capacity U = Under capacity <xxxxxxxx = weight value. This field is always 10 characters long. E = Zero error I = Initial zero err T = Tare error <uuu = units of meas. This field is always 3 characters long> <r = range status I = normal <n = gross/net status G = Gross normal
Zero the Scale	Z	Z	Z1G 0lb See standard response defined under SMA command W .

SMA Level 2 Protocol

This document outlines commands currently defined in the Scale Manufacturers Association (SMA) Standard Scale Serial Communication Level 2 Protocol currently supported by the MSI9000 CellScale. The CellScale must be setup with the Terminal Interface program to respond to SMA commands.

Note: all SMA style inputs and outputs are preceded by a line feed (0x0A) and followed by a carriage return (0x0D). Level 1 commands are supported by Level 2.



Description	Cmd	Input examples	Output examples & comments *= a space or place holder	
Clear Tare Weight	C	C	1G	4550lb <i>See standard response defined under SMA command W.</i>
Output High Resolution Weight	H	H	<i>This command is not relevant.</i>	
Send 1st line of "About" data.	I	I	SMA:2/1.0 <i>SMA compliance level 2 / revision 1.0</i>	
Output current Tare Weight	M	M	1T	250lb <i>See standard response defined under SMA command W.</i>
Send nth line of "About" data.	N	N	TYP:S CAP:lb :25000:10:0 CAP:kg :5.00:2:3 CMD:ABCDIMNPRTUWXZ END: ? ?	<i>Repetitive 'N' commands will send out consecutive lines of 'info' data. After all lines are output, further 'N' commands will display question marks. Reset the process by sending another 'T' command. Capacity lines show capacity for each defined input channel. Capacity lines show units:capacity:countby:dec. pt. Command lines show the defined, available SMA Level 2 commands.</i>
Output Stable Weight	P	P	1G	16550lb <i>See standard response defined under SMA command W. This command will pend until the weight stabilizes.</i>
Output High Resolution Weight	Q	Q	<i>This command is not relevant.</i>	
Continuous Output of Weight	R	R	1G 1GM 1GM 1G	16550lb 16500lb 16500lb 16500lb <i>See standard response defined under SMA command W. This command outputs continuously until a new SMA command is received. The user can change the output rate on the CellScale terminal menu.</i>
Continuous Output High Resolution Weight	Q	Q	<i>This command is not relevant.</i>	
Set Tare Weight	T	T T2500	1N 1N	0lb -2500lb <i>See standard response defined under SMA command W. A solitary 'T' performs an auto tare on the current load. A 'T' followed by one or more numerical digits uses the input as a tare value. This command is subject to all other rules that apply to tare. Motion, limits, etc.</i>
Change Units	U	U U U U U Ukg	1G 1G 1G 1G 1G 1G	1135kg 1.250ton 1.135t 1110dan 2500lb 1135kg <i>See standard response defined under SMA command W. A solitary 'U' sets the scale to the next available unit of measure. A 'U' followed by 3 characters that represent a valid unit sets the scale to that unit. This command is subject to all other rules that apply to units. Lockouts, capacity, etc. Valid units are always 3 chars.</i> <i>lb. = Pounds</i> <i>kg = Kilograms</i> <i>ton = US tons</i> <i>t = Metric tons</i> <i>oz = Ounces</i> <i>g = Grams</i> <i>dan = Deka-Newtons</i>
Extended MSI Command Set	X	X	<i>This command is not relevant.</i>	

APPENDIX A – SPECIFICATIONS

HARDWARE OVERVIEW:

Electronics

- μ C Board: 6 layer SMD, AM186ESLV based w/ Flash Memory – Fits in center well. 512kbytes of Flash Program Memory, 512kbytes of non-volatile RAM.
- Power Supply / I/O Board: power regulation and I/O for MM – Fits in center well. Input range 9-30V. Optional direct AC board 85-265VAC (also useful for HVAC inputs from 120VDC to 300VDC).
- 2 Channel A/D Board: 4 layer SMD, 24bit A/D. Up to 2 per unit. Fits in left well.
- Highly integrated Radio Modem: 2.4GHz Spread Spectrum. Available with multiple antenna options.
- 2 Comm ports, programmable for RS-232, RS-422, or RS-485. Baud rates to 230.4K
- 3 Isolated relays internal (60V 500mA). Firmware for I/O modules on RS-485 (Grayhill ProMux compatible). Use for up to 32 outputs.
- Status Lights

Housing

- Milled Aluminum. O ring gasketed. NEMA 4, IP66 w/ Standard Antenna, NEMA 6, IP67 w/ Long Range Antenna (Waterproof to 1M submersion).

GENERAL FEATURES

Channels 1-4 – Scale Input Channels

- Up to 40 350 Ω cells total. 6 Terminal connections plus shield. Independent readings of 16 scales (32 independent with two A/D modules). Standard configuration is 2 Channel inputs.

Channel 5

- Channel 5 allows access to inputs from Slave CellScales

Channel 6

- Channel 6 is math calculations. Up to 8 separate math channels can be used to combine conversions from multiple channels. Supported functions are: multiply, divide, add, subtract, absolute value, square root, and constants. Multiple levels of parentheses are available for any scaling or channel data manipulation formulas.

External Multiplexer

- Depending on connector and A/D board configuration, the CellScale can read up to 32 load receptors independently using external multiplexer modules. Each Multiplexer includes up to 8 inputs. Because Excitation is switched for every other channel, the total Load Cell driving capability is quadrupled to 160 350 Ω load cells

Excitation

- 5 V (+5V relative to ground). Current limited and over-voltage protected to Factory Mutual standards. AC (switched DC) or DC excitation.

Radio Link

- Frequency Hopping Spread Spectrum in 64 channels @ 2.4 GHz. Allows 64 collocated networks scales and peripheral devices. 802.11 avoidance settings available.

Push-button

- Programmable– Two inputs on power connector. 1 isolated input on set points connector. The isolated input shares function with Switch 1. Not needed for normal operation.

RFI/EMI Shielding

- Exceeds NIST HB44 and European Standards.

Dimensions

- 8.75" x 5.5" x 1.425 (1.5" including lid closure screws)
- 223mm x 140mm x 36mm (38mm including lid closure screws)

Weight

- 3.5 lb.. (1.6kg)
- Shipping Weight 6 lb. (2.7kg) est.

Auto Sleep Mode

Off, 12 min., or 1 Hr., senses operational status to determine action. Wakes up automatically with change in status. Sleep mode for RF System wakes unit up under programmed conditions: 1) Scale activity exceeding a set weight parameter 2) Contact closure 3) Wake up on elapsed time 4) Wake up on real time.

Real Time Clock

Supports date/time stamping in US or European time and date. Provides triggers for data logging. Backed up by a replaceable Lithium Battery (Typical life >5 years).

Units

lb., kg, Ton, Ton (metric), oz, g, daN, user defined.

Data I/O

2 Comm Ports, programmable for RS-232, 422, or 485. The second Comm Port is mux'ed with the Radio Modem and not available full time. RS-485 termination must be external. Baud Rates: 1200, 2400, 4800, 9600, 19.2k, 38.4k, 115.2k, 230.4k. CTS/RTR handshaking when in RS-232 mode.

External Input

1 Opto-isolated input to interface the MM with customer inputs. Fully isolated and capable of direct voltage inputs to 48V. In parallel with Switch 2 input.

Accelerometer/Tilt Transducer

Dual axis accelerometer/tilt transducer option provides correction data for scale in motion or scale in tilt correction. Direct angle readout or acceleration readout. Digitally temperature compensated. Also provides direct temperature indication.

ID

Alpha-numeric ID names up to 32. Each ID stores Totals, Tare values, Units and two 20 byte string messages. Customize for Weigh-in / Weigh-out or Statistics registers.

Totalization and Statistics

Push button or Automatic. Total weight up to 999,999,999. Container counter up to 65,535. Totals are stored with each ID register. Min, Max, Average, Standard Deviation, and Coefficient of Variance computed and stored for each ID.

Internal Set Points

3 Contacts internal (SS Relays). Programmable for form A or form B (normally open or normally closed). Relays rated for 60V @ 350mA. 2.5Ω maximum contact resistance.

External Set Points

Up to 744 (31 locations, 24 port I/O boards) Set points externally addressed on RS-485 output. The external set points are designed to use industry standard I/O Modules running on Grayhill ProMux networks.

Annunciators

Seven (7) LED Status lights: 1) Power – ultrabright RED. Slow blink for Power OK. 2) SP1. Dual color, green for enabled, red for triggered. 3) SP2. 4) SP3. 5) Comm Port 1 Status. Dual Color, red for fault,



green for good. 6) Comm Port 2 Status. 7) Excitation On: Green. A/D fault: Red.

Connectors

Channel Input Connections are made with a Mil Style PT connector. Power and I/O connections are made with heavy duty waterproof industrial connectors (Eurostyle) using pre molded waterproof cord sets.

4-20mA Output Option

16 bit resolution. Compliance 6.5V to 100V. Zero (4mA) and span (20mA) programmable for any weight range.

A/D CONVERSION SPECIFICATIONS

Integral Nonlinearity

- 18 PPM of Full Scale Maximum

Input Impedance

- >10M on all Load Cell Inputs.

Offset Drift vs. Temp

- AC Excitation Mode: $5\text{nV}/^{\circ}\text{C}$ DC Excitation Mode: $0.5\mu\text{V}/^{\circ}\text{C}$

Note: AC Excitation not available in Fast Conversion Mode.

Offset Drift vs. Time

- AC Excitation Mode: $25\text{nV}/1000\text{hrs}$ typ.
- DC Excitation Mode: $3\mu\text{V}/1000\text{hrs}$ typ.

Gain Drift vs. Temp

- AC or DC Excitation Mode: $2\text{PPM}/^{\circ}\text{C}$

Gain Drift vs. Time

- 10PPM/1000hours typical

RF MODEM SPECIFICATIONS

FCC Certification Part 15.247, no license required

ETSI (European) Certification brETSI 300.328, no license required

Rated RF Power +24 dBm / 250mW (Hi), +18dBm / 63mW (Med), +10dBm / 10mW (Low)

Line-of-site Range approx. 6/10 of a mile w/2dB dipole. Much further range with gain and/or directional antennas.

Frequency Range 2401 – 2495MHz

Number of Channels 86 US

Receiver Sensitivity -92dBm @ 10⁻⁵ BER

Channel Data Rate 460Kbps

IF Adjacent Channel Rejection >55dB

APPENDIX B – ASCII CHART

DEC	HEX	CHAR	DEC	HEX	CHAR	DEC	HEX	CHAR	DEC	HEX	CHAR
0	00	^@ NUL	32	20	SPC	64	40	@	96	60	`
1	01	^A SOH	33	21	!	65	41	A	97	61	a
2	02	^B STX	34	22	"	66	42	B	98	62	b
3	03	^C ETX	35	23	#	67	43	C	99	63	c
4	04	^D EOT	36	24	\$	68	44	D	100	64	d
5	05	^E ENQ	37	25	%	69	45	E	101	65	e
6	06	^F ACK	38	26	&	70	46	F	102	66	f
7	07	^G BEL	39	27	'	71	47	G	103	67	g
8	08	^H BS	40	28	(	72	48	H	104	68	h
9	09	^I HT	41	29	)	73	49	I	105	69	i
10	0A	^J LF	42	2A	*	74	4A	J	106	6A	j
11	0B	^K VT	43	2B	+	75	4B	K	107	6B	k
12	0C	^L FF	44	2C	,	76	4C	L	108	6C	l
13	0D	^M CR	45	2D	-	77	4D	M	109	6D	m
14	0E	^N SO	46	2E	.	78	4E	N	110	6E	n
15	0F	^O SI	47	2F	/	79	4F	O	111	6F	o
16	10	^P DLE	48	30	0	80	50	P	112	70	p
17	11	^Q DC1	49	31	1	81	51	Q	113	71	q
18	12	^R DC2	50	32	2	82	52	R	114	72	r
19	13	^S DC3	51	33	3	83	53	S	115	73	s
20	14	^T DC4	52	34	4	84	54	T	116	74	t
21	15	^U NAK	53	35	5	85	55	U	117	75	u
22	16	^V SYN	54	36	6	86	56	V	118	76	v
23	17	^W ETB	55	37	7	87	57	W	119	77	w
24	18	^X CAN	56	38	8	88	58	X	120	78	x
25	19	^Y EM	57	39	9	89	59	Y	121	79	y
26	1A	^Z DUB	58	3A	:	90	5A	Z	122	7A	z
27	1B	^[ESC	59	3B	;	91	5B	[	123	7B	{
28	1C	^\ FS	60	3C	<	92	5C	\	124	7C	|
29	1D	^[GS	61	3D	=	93	5D	]	125	7D	}
30	1E	^^ RS	62	3E	>	94	5E	^	126	7E	~
31	1F	^_ US	63	3F	?	95	5F	_	127	7F	DEL

APPENDIX C – WORKSHEETS

See attached PDF files for CellScale Work Sheets.



THE MSI LIMITED WARRANTY

MEASUREMENT SYSTEMS INTERNATIONAL, INC., WARRANTS load sensing elements and meters against defects in workmanship and materials for a period of one year from date of purchase and warrants electrical cables and batteries against the same defects for a period of ninety (90) days from date of purchase.

Any device which proves defective during the warranty period will be replaced or repaired at no charge; provided that the defective device is returned to the Company freight pre-paid.

In no event shall the Company be liable for the cost of any repairs or alterations made by others except those repairs or alterations made with its specific written consent, nor shall the Company be liable for any damages or delays whether caused by defective workmanship, materials or otherwise.

The Company shall not be liable for any personal injury or property damage resulting from the handling, possession or use of the equipment by the customer.

The warranty set forth herein is exclusive and is expressly in lieu of all other warranties, express or implied, including without limitation any implied warranties of merchantability or fitness, or of any other obligations or liability on the part of the Company.

The liability of the Company under this warranty is limited solely to repairing or replacing its products during the warranty periods; and the final judgment and disposition of all claims will be made by MEASUREMENT SYSTEMS INTERNATIONAL, INC.



**Measurement Systems
International™**

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