iQube²®

Installation Manual

1280 Enterprise™ Indicator

920i® Programmable HMI Indicator

Virtui2® PC-based HME

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W E I G H I N G   S Y S T E M S

Contents

*Technical training seminars are available through Rice Lake Weighing Systems. Course descriptions and dates can be viewed at **www.ricelake.com/training** or obtained by calling 715-234-9171 and asking for the training department.*

*Rice Lake continually offers web-based video training on a growing selection of product-related topics at no cost. Visit **www.ricelake.com/webinars***

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1.0   Introduction

This manual is intended for use by service technicians responsible for installing and servicing iQUBE[2] digital diagnostic junction boxes. This manual applies to Version 1.0 or later of the iQUBE[2] software.

For applications using the 920i [®] indicator as a host device, Version 4.0 or later of the 920i indicator software must be installed.

For applications using the 1280 indicator as a host device, Version 1.03 or later of the 1280 indicator software must be installed.

For installations using the 920i indicator, the indicator can be configured using the iRev, Version 4 or later, configuration utilities, serial commands, or the indicator front panel keys.

Configuration and calibration of the iQUBE[2] can also be accomplished using Virtui2.

Manuals can viewed or downloaded on the Rice Lake Weighing Systems distributor site at www.ricelake.com

Warranty information can be found on the website at www.ricelake.com/warranties

1.1   Safety

Safety Signal Definitions:

⚠ DANGER	*Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. Includes hazards that are exposed when guards are removed.*
⚠ WARNING	*Indicates a potentially hazardous situation that, if not avoided could result in serious injury or death. Includes hazards that are exposed when guards are removed.*
⚠ CAUTION	*Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury.*
IMPORTANT	*Indicates information about procedures that, if not observed, could result in damage to equipment or corruption to and loss of data.*

General Safety

Do not operate or work on this equipment unless this manual has been read and all instructions are understood. Failure to follow the instructions or heed the warnings could result in injury or death. Contact any Rice Lake Weighing Systems dealer for replacement manuals.

⚠ WARNING

Failure to heed could result in serious injury or death.

Some procedures described in this manual require work inside the iQUBE[2] or indicator enclosure. These procedures are to be performed by qualified service personnel only.

Do not allow minors (children) or inexperienced persons to install/operate this unit.

Do not operate without enclosure completely assembled.

Do not place fingers into slots or possible pinch points.

Do not use this product if any of the components are cracked.

Do not make alterations or modifications to the unit.

Do not remove or obscure warning labels.

Do not submerge.

Before opening the unit, ensure all power is disconnected.

1.2 Overview

The iQUBE^2 is a digital programmable junction box with advanced diagnostic and multi-scale capabilities. A single 4-channel iQUBE^2 board can be configured to support up to four individual scales plus their sum. The modular design allows for the connection of up to four iQUBE^2 circuit boards to define a scale system of up to 16 full bridge analog load cells. An ASCII-based command set allows the iQUBE^2 to be configured and controlled by any programmable host that supports the command set.

1.2.1 Hardware

The CPU board (PN 106390) provides four load cell input channels, four configurable I/O channels, a selectable multi-protocol communications port (RS-232, 2- or 4-wire RS-485) and an additional port that accepts various Rice Lake option cards (see Table 1-2 on page 3) for simultaneous communications with multiple hosts.

1.2.2 System Models

The enclosures are available in both fiberglass and stainless steel, with or without a power supply, and in a variety channel configurations. See Section 1.3 on page 3.

1.2.3 Digital I/O

Each CPU board provides four channels of digital I/O.

Digital inputs can be set to provide indicator functions, including four keys plus cell health and setpoints. The primary CPU board has four digital inputs/outputs; any secondary CPU boards are used for cell health only.

1.2.4 Configuration

The iQUBE^2 is designed for use with any host device capable of sending and receiving ASCII text. A simple communications program, such as HyperTerminal, can be used to configure the most complex system and monitor all diagnostic capabilities.

In addition, Rice Lake Weighing Systems provides three additional interfaces for configuring and controlling:

- The 1280 Enterprise indicator, using the iQUBE^2 configuration screens, using the front panel or Revolution configuration utility (Revolution module for the 1280 which includes iQube2 configuration or an iQube2 Revolution module which can connect directly to the iQube2), see Section 3.0 on page 21.
- The 920i Programmable HMI Indicator/Controller, using the 920i menus or the iRev 4 configuration utility, see Section 4.0 on page 34.
- The Virtui2® PC-based HMI, PC-based indicator and configuration utility, see Section 5.0 on page 45.

Note *Any indicator capable of operation as a serial scale can be configured and used as the indicating element.*

1.2.5 Diagnostics

Advanced diagnostic capabilities include:

- Power supply and excitation voltage monitoring
- Load cell connection faults
- Load cell overload, under-load, balanced load, load cell drift, peak-to-peak noise and zero reference errors

Diagnostic information can be included in weight data or monitored on a communications channel separate from weight data.

See Section 7.0 on page 62 for more information about diagnostics.

1.2.6 Transient Protection

Transient protection boards are designed to protect the power supply lines by minimizing the effects of nearby lightening strikes and other extreme transients.

Transient protection boards are recommended on each end of a power supply run when an external DC supply is used, or on power supply cables to secondary units where the secondary enclosure runs are longer than 75'.

The transient protection board option (PN 110949) includes a mounting bracket.

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1.3   System Configurations and Options

The iQUBE^2 is available in fiberglass or stainless steel enclosures.

- 8" x 10" – accommodates 1-2 CPU boards, up to 8 channels
- 10" x 12" – accommodates 1-3 CPU boards, up to 12 channels
- Maximum system configuration – accommodates 4 CPU boards, up to 16 channels and requires at least two enclosures.

Model	Part No.	Channels	Enclosure Material	Enclosure Size (inches)	Power Supply (PN 76556)
iQUBE^2-AA	108425	4	FRP	8 x 10	Yes
iQUBE^2-AB	108429	4	FRP	8 x 10	No
iQUBE^2-AA	108426	4	FRP	10 x 12	Yes
iQUBE^2-AB	108430	4	FRP	10 x 12	No
iQUBE^2-AA	108427	8	FRP	10 x 12	Yes
iQUBE^2-AB	108431	8	FRP	10 x 12	No
iQUBE^2-BA	108428	4	SST	8 x 10	Yes
iQUBE^2-BB	108432	4	SST	8 x 10	No

Table 1-1. Available System Models

1.3.1   Communications Option Cards

The option cards listed in Table 1-2 are available to extend the communications capabilities of the iQUBE^2. The option cards are installed in connector J9 on the CPU board (see Figure 2-4 on page 9).

Model / Option	Part No.
Fiber-optic interface card	77143
Ethernet interface card	77142
Wireless Ethernet card	108671
USB interface card	93245
Serial interface card	108579

Table 1-2. Communications Option Cards

1.3.2   Power Supply Options

The iQUBE^2 can be powered by either the internal 7.5 VDC power supply (PN 76556) or by an external 12 VDC power supply (PN 108434). The external DC power supply is mounted in its own 8" x 6" x 4" enclosure and includes a transient protection board for circuit protection.

See Section 9.2 on page 72 for information about calculating power requirements for particular system configurations.

1.4   Support Software

The iQUBE^2 allows several methods of configuration, calibration and operation. In addition to support software listed in this section, serial commands can be used for system configuration via a PC attached to a serial port.

1.4.1   Virtui2

Virtui2 is a virtual indicator interface for scale operations using the iQUBE^2. It contains the Virtui2 Configuration Utility, a separate windows application, which supports configuration and calibration for the iQUBE^2. Use the Toolkit CD (PN 108435) to install Virtui2; it is included in the parts kit.

Minimum system requirements for Virtui2: 1GHz processor, 1GB RAM, 400MB disk space, serial port or Ethernet, 1024x768 or greater resolution monitor. Windows XP SP3 (32-bit), Windows Vista (32-bit or 64-bit).

See Section 5.1 on page 46 for more information.

1.4.2   Supporting Indicators

The iQUBE^2 supports any indicator as a serial scale. The 1280 and 920i provide special functionality to work in conjunction with the iQUBE^2, allowing for configuration, calibration, and diagnostics.

1.5   Printed Information

iQUBE² Options

- Fiber-Optic Interface Installation Instructions, PN 80230
- Ethernet Communications Installation Manual, PN 77224
- USB Communications Card Installation Instructions, PN 95490
- Serial Communications Expansion Card Installation Instructions, PN 110892
- Remote Power Supply Installation Instructions, PN 110564

920i System Manuals

- 920i Installation Manual, PN 67887

1280 System Manuals

- 1280 Technical Manual, PN 167659

2.0   Installation

This section describes procedures for connecting load cell, power and serial communications cables to the iQUBE^2 junction box. Assembly drawings and replacement parts lists for the iQUBE^2 are included.

> ⚠ **WARNING** *Some procedures described in this manual require work inside the iQUBE^2 or indicator enclosure. These procedures are to be performed by qualified service personnel only.*
>
> *Before opening the unit, ensure all power is disconnected.*
>
> *Use a wrist strap for grounding and protection of components from electrostatic discharge (ESD) when working inside the iQUBE^2 enclosure.*

2.1   Unpacking and Assembly

Immediately after unpacking, visually inspect the iQUBE^2 and the parts list to ensure all parts are included and undamaged. If any parts were damaged in shipment, notify Rice Lake Weighing Systems and the shipper immediately.

Parts kit contents for 4- and 8-channel models of the iQUBE^2.

Part No.	Description	Quantity	
		4-ch	8-ch
14861	Machine screws, 8-32NC x 3/8	8	12
15134	Lock washers, No. 8 Type A	8	12
15631	Cable ties, 3-in.	5	5
15665	Reducing glands, 1/2 NPT	2	2
19538	Slotted posts, 1/4 x 1	8	10
53075	Ground cable clamps	8	12
66730	Ferrite EMI suppression filters	4	8
76513	4-position screw terminal connector	1	2
76514	6-position screw terminal connectors	6	12
94422	Capacity label	1	1
108435	Toolkit CD	1	1

Table 2-1. Parts Kit Contents

2.2   Mounting the Enclosure

The iQUBE^2 can be mounted either vertically or horizontally to a flat surface.

If the iQUBE^2 will be attached to the building surface, a power supply cord mat be used for connection to the AC main supply, provided the conditions in this section are met.

2.2.1   UL Equipment Considerations

The iQUBE^2 should not be installed as a permanent part of the building structure. This includes Equipment For Building-In (per UL Document 1.2.3.5). The iQUBE^2 must be removable from the building surface.

2.2.2   UL Power Considerations

The power supply cord must not be attached to the building surface, nor run through walls, ceilings, floors and similar openings in the building structure.

Installation measures must be taken to prevent physical damage to the power supply cord. Properly route the power supply cord and position the iQUBE^2 near an outlet, to allow for quick disconnect in case of an emergency.

2.3   Cable Connections

All models of the iQUBE^2 provide cord grips for cabling into the unit, plus a dedicated cord grip for a ground wire. Up to 12 load cells can be cabled into the iQUBE^2 (in large FRP model only); other cord grips allow cabling for serial communications, digital I/O, and AC power. Install plugs in all unused cord grips to prevent moisture from entering the enclosure.

2.3.1 Cable Grounding

Except for the power cord, all cables routed through the cord grips should be grounded against the indicator enclosure.

1. Install the grounding clamps on grounding studs, using the ground clamp hardware. Do not tighten the screws at this time.

2. Route the cables through the cord grips and the grounding clamps to determine the cable lengths required to reach the cable connectors.

3. Mark the cables to remove insulation and shield. See the following information on **Stripping Cables**.

4. Route stripped cables through the cord grips and grounding clamps.

5. Ensure the shields contact the grounding clamps as shown in Figure 2-1 and Figure 2-2. Tighten the ground clamp screws.

Stripping Cables

Foil Insulated Cable
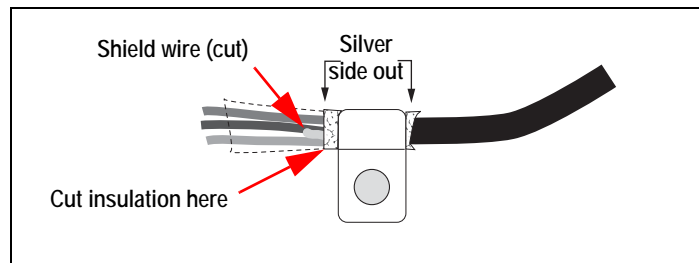
Figure 2-1. Foil Insulated Cable

1. Strip the insulation and foil from the cable 1/2" (15 mm) past the grounding clamp.

2. Fold the foil shield back on the cable where the cable passes through the clamp.

3. Ensure the silver (conductive) side of the foil is turned outward for contact with the grounding clamp.

Braided Shielding
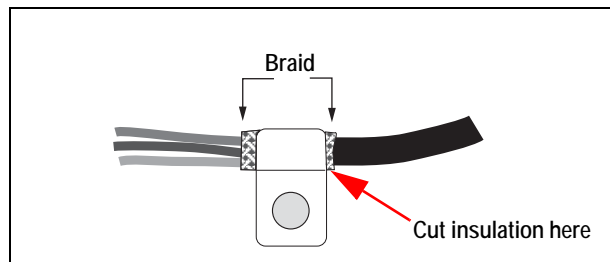
Figure 2-2. Braided Shielding

1. Strip the insulation and braided shield from a point just past the grounding clamp.

2. Strip another 1/2" (15 mm) of the insulation to expose the braid where the cable passes through the clamp.

Load Cell Cables

Cut the shield wire just past the grounding clamp. Shield wire function is provided by contact between the cable shield and the grounding clamp.

2.4   Transient Protection

IMPORTANT   *Improper grounding systems can cause costly lightening damage to electronics. Always strive for a single-point grounding system. Refer to the product manual for proper grounding techniques.*

Figure 2-3 illustrates a generic single point grounding system.
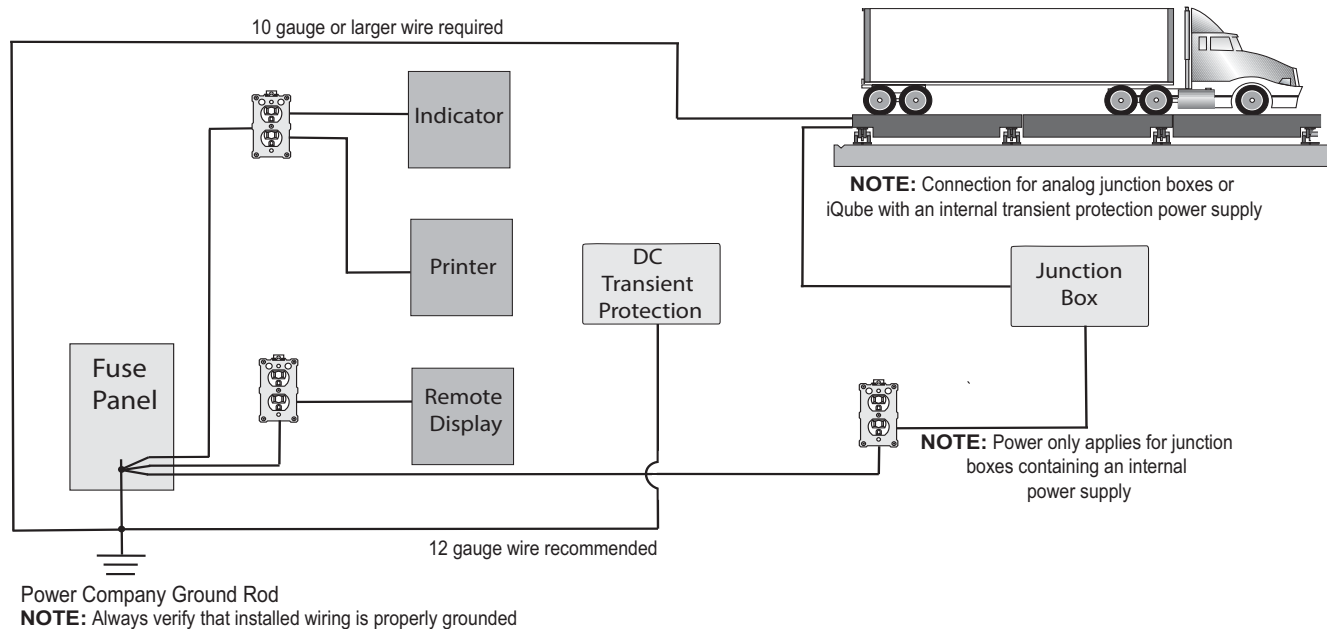
Figure 2-3. Truck Scale Single Point Grounding Example

2.5   Load Cells

IMPORTANT	*Diagnostics may not function properly with load cells having a bridge resistance greater than 700 ohms. Customers wanting to use load cells with a higher bridge resistance than 700 ohms can consult the Rice Lake Weighing Systems service department for additional options.*

When load cells are wired to iQUBE[2] connectors, J1-J4 are assigned by default as channels 1-4 (5-8, 9-12, 13-16 for secondary units). The graphic representations of the weighing platform shown when configuring the scale, assumes particular locations for each load cell, based on the connector used. Load cells can be renamed during configuration.

While load cells can be wired to any connector on the iQUBE[2] connector board, platforms defined as paired sections (including most truck scale applications) must correctly associate these pairs to ensure valid calibration and diagnostic functions.

2.5.1   Load Cell Wiring

To attach load cell cables to the CPU board:

1. Route the cables through the cord grips on the load cell connector end of the enclosure.

2. Strip 1/4" of insulation from the ends of the load cell wires.

3. Install wires into the connectors as shown in Table 2-2.

4. Use cable ties and mounts to secure the load cell cables to the enclosure, when connections are complete.

WARNING	*Pins 5 and 6 provide connections for load cells that provide TEDS (Transducer Electronic Data Sheet) information.* *Do not connect sense wires to the TD terminals.*

Pins (J1–J4)	Function
1	+SIG
2	–SIG
3	+EXC
4	–EXC
5	+TD (TEDS)
6	–TD (TEDS)

Table 2-2. Load Cell Connector Pin Assignments

Note	*For load cells with a resistance greater than 2,200 Ohms, a high precision 2k Ohm resistor should be placed between the EXC+ and EXC- pins of the load cell connection to maintain correct operation of the Cell Connect diagnostic.* *Precision resistor properties: Temperature Coefficient ±10 ppm/°C; Tolerance ±1%*
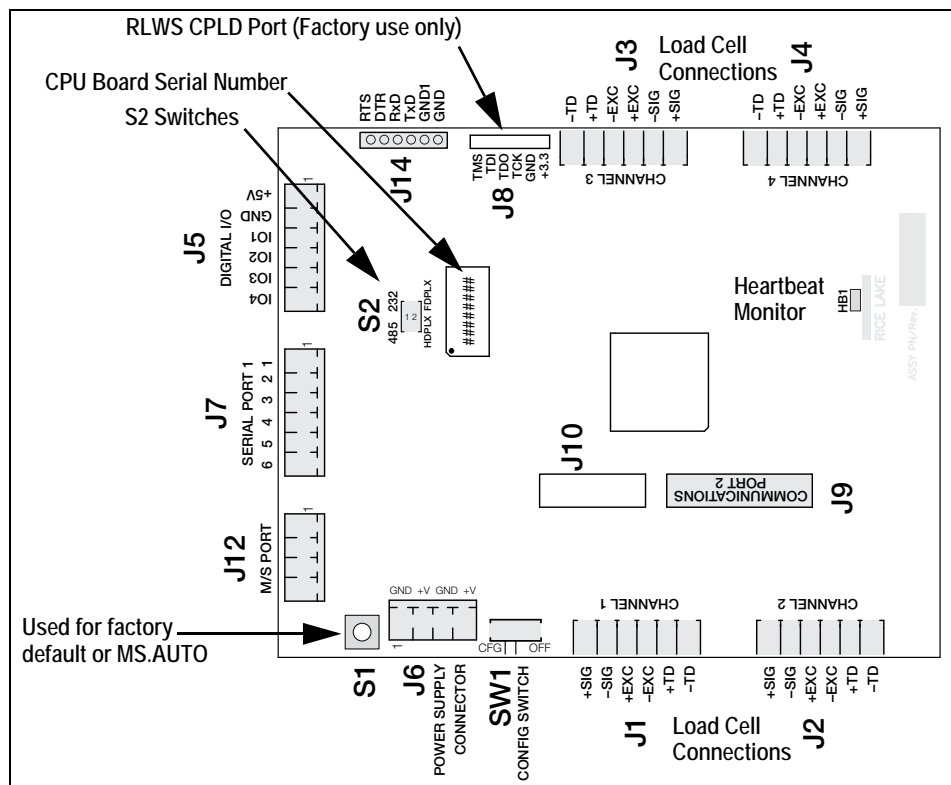
Figure 2-4. iCPU Board

> **Note** *HB1 is a heartbeat monitor which monitors processor activity. Blinking once per second indicates normal operation. As either errors or COM port activity increases, HB1's blinking may slow down to reflect the added activity.*

2.6   Serial Communications

Serial communications between the iQUBE[2] and host or peripheral devices is provided by two ports.

- Port 1 – provides onboard RS-232 (full-duplex) or RS-485 (full- or half-duplex) communications on connector J7. S2 on the CPU board is a pair of switches that are used to select the required setting

- Port 2 – uses an option card installed in connector J9 to expand the communication capabilities of the iQUBE[2]. Available option cards support fiber-optic, wired and wireless Ethernet, USB, and RS-232/RS-485 communications

To attach serial communications cables, route the cable through the cord grip and wire to the connector on the CPU board. Use cable ties to secure serial cables to the inside of the enclosure.

2.6.1   Port 1 Communications
Table 2-3 shows the pin assignments for Port 1 connector J7.

J7 Pin	RS-232 Signal	RS-485 2-Wire Signal	RS-485 4-Wire Signal
1	GND1	GND1	GND1
2	RxD	—	Rx+
3	—	—	Rx–
4	—	A / +	Tx+
5	TxD	B / –	Tx–
6	—	—	—

Table 2-3. Port 1 Pin Assignments

> **Note** *The switches are only read on power-up; if switch settings are changed, cycle power to the iQUBE[2] before attempting to communicate using Port 1.*

Port	Selections	Settings
1	RS-232 RS-485	On Off
2	RS-485 Only	2-Wire 4-Wire

Table 2-4. S2 Switch Settings

RS-485/422 Connections to Host Indicators
See Section 4.0 on page 34 for connection to the 920i.

See Section 3.0 on page 21 for connection to the 1280.

Selecting Communication Type for Port 1
To select communication protocols on Port 1:

1. Remove power from the iQUBE[2].

2. Place the S2 switches in the proper position for the communication type to be used. See Table 2-4.

3. Place SW1 in the *CFG* position.

4. Apply power to the iQUBE[2].

5. Place SW1 in the *OFF* position.

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2.6.2 Communications Option Cards

Table 2-5 lists communications option cards available for the iQUBE^2. Communications option cards are installed in the J9 connector of the primary CPU board for the iQUBE^2 system. All option cards use Port 3 except for wireless Ethernet, which uses Port 2.

Option	PN
Fiber-optic interface card	77143
Ethernet interface card IEEE 802.3	77142
Wireless Ethernet card IEEE 802.11g	108671
USB interface card	93245
Serial interface card	108579

Table 2-5. Communications Option Cards

2.6.3 Communications Cable Distance Limitations

The maximum cable lengths that can be used for the communication types depend on a number of factors.

- Output impedance of the transmitter
- Electrical noise in the environment
- Cable capacity, wire gauge, termination, shielding and baud rates.

Use the distances in Table 2-6 as a general guide for communication cabling.

Cable Type	Distance
RS-232	50' (15 m) @ 19,200 Baud (10' @ 115,200 Baud)
RS-485	1000' (300 m) twisted pair cable @ 115,200 Baud
Fiber-optic	375' (114 m)
Ethernet Cat5	330' (100 m)
USB	16.5' (5 m)
802.11g	330' (100 m) under optimal conditions

Table 2-6. Communication Cable Limitations

Data rate decreases with distance. See Table 2-7.

Note	*Ethernet port is not suitable for connection to circuits used outside the building and is subject to lightning or power faults.*

Data Rate	Approx. Range
54 Mbps	65'
48 Mbps	80'
36 Mbps	115'
24 Mbps	140'
18 Mbps	170'
11 Mbps	180'
9 Mbps	190'
5.5 Mbps	215'
3 Mbps	260'
1 Mbps	330'

Table 2-7. Approximate 802.11g Data Rate/Range

2.7   Digital I/O

Each iQUBE[2] board provides four channels of digital I/O.

Digital inputs can be set to provide many indicator functions, including four keys (**Zero**, **Tare**, **Units**, **Mode**) plus cell health, and setpoints. See Table 6-10 on page 60 for a complete listing. The four digital inputs/outputs on the primary CPU are configurable; any secondary CPU board's I/O are used for cell health only.

The fastest I/O reaction times are achieved when the iQUBE[2] controls its own free-running setpoints using its own local I/O (2 milliseconds). If preacts are required, the host device should be used as the controller for its own I/O.

Rice Lake does not recommend the use of iQUBE[2] (local) I/O with host device controlled setpoints using the preact functions as variances in the reaction time in serially controlled I/O can dramatically affect the preact algorithm.

Cell Health

The iQUBE[2] CPU board provides bi-color cell status LEDs next to each load cell connector. These LEDs indicate the status of connected load cells.

LED Color	Meaning
Green	Load cell is good
Red	Load cell error
Red/Green Flashing	Consistent error being cleared by host
Off	Disabled/load cell not assigned to a scale

Table 2-8. LED Status Indications

Digital inputs are active/low (0 VDC), inactive/high (5 VDC). Digital I/O are active/low if the CPU board's LED color is green.

Digital outputs are typically used to control relays that drive other equipment. Outputs are designed to sink, rather than source, switching current.

Each output is a normally open collector circuit, capable of sinking 25 mA when active. Digital outputs are wired to switch relays when the digital output is active (low, 0 VDC) with reference to a 5 VDC supply.

Table 2-9 shows the pin assignments for connector J5.

J5 Pin	J5 Signal
1	+5V
2	GND
3	I/O 1
4	I/O 2
5	I/O 3
6	I/O 4

Table 2-9. J5 Pin Assignments (Digital I/O)

2.8   Primary/Secondary Wiring and Configuration

An iQUBE[2] system can consist of up to four boards, with up to four load cell channels wired to each board. Standard enclosures can accommodate one or two boards; large enclosures allow up to three boards. For control of a multi-board system, one board is assigned as the primary unit and the J12 connector (M/S port) is used to provide communication between the primary and up to three secondary units.

Figure 2-5 shows the primary-to-secondary wiring for multiple iQUBE[2] boards. Successive secondary units are wired in parallel (A to A, B to B, GND to GND) to the J12 connector of each iQUBE[2] board.

Note	*The M/S port provides RS-485 communications at approximately 450 KBPS. This port is reserved for communication between iQUBE[2] boards. No other devices should be connected to this port.*

J12 Pin	Primary iQUBE^2	Secondary iQUBE^2
1	iQA	iQA
2	iQB	iQB
3	GND2	GND2
4	GND2	GND2

Table 2-10. J12 Primary/Secondary Port
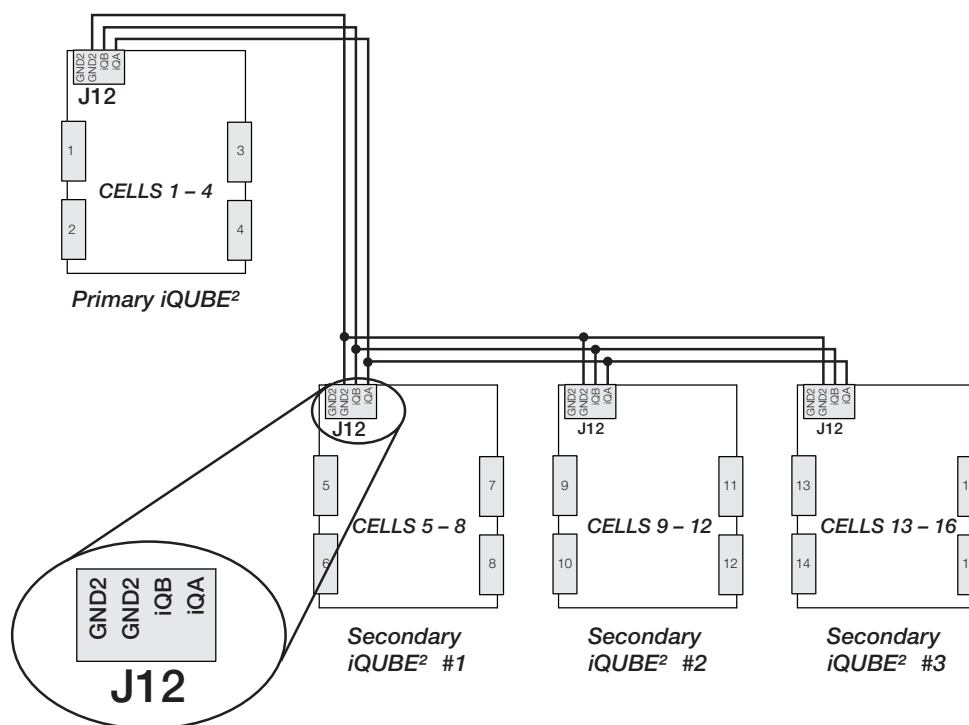
Figure 2-5. Primary-to-Secondary Communications Wiring

> **Note** *The cell numbering for secondary units follows the sequence of the load cell connector designations, with connectors J1–J4 of the first secondary unit assigned cells 5–8, as shown in Table 2-11*

Load Cell Connector	Primary Cell Numbers	Secondary #1 Cell Numbers	Secondary #2 Cell Numbers	Secondary #3 Cell Numbers
J1	1	5	9	13
J2	2	6	10	14
J3	3	7	11	15
J4	4	8	12	16

Table 2-11. Cell Numbering for Multiple-Board System

2.8.1   Assigning Board Addresses

Once the primary and secondary unit ports are wired (Figure 2-4 on page 9), their addresses must be assigned. There are two ways to assign the secondary board addresses in an iQUBE^2 system: manual entry or automatic, push-button assignment.

2.8.2   Manual Entry

Manual address assignments are done by manually entering the secondary board IDs and the desired addresses in the Virtui2 Configuration Utility or the indicator being used.

2.8.3   Start Auto Assign Procedure

For the 920i - The *MS.AUTO* algorithm can be started via software using a terminal program and sending the MS.AUTO command to the iQube2 or by pressing the **Auto Assign** softkey in the *Boards* menu of the 920i. Additionally, the following hardware implementation of the MS.AUTO algorithm can be used when no HMI is connected or the HMI is not easily accessible.

For the 1280 - The *MS.AUTO* algorithm can be started via software using a terminal program and sending the MS.AUTO command to the iQube2 or by pressing the **Start Auto Assign Procedure** in the *Boards Assignment* menu of the 1280. Additionally, the following hardware implementation of the MS.AUTO algorithm can be used when no HMI is connected or the HMI is not easily accessible.

1. Place the desired primary iQUBE^2 into setup mode by setting SW1 to CFG.

2. Remove power to the primary iQUBE^2 by unplugging the J6 connector from the CPU board.

3. Press and hold **S1** and return power to the CPU board by reconnecting J6.

4. Once J6 is reconnected, release **S1** to begin the MS.AUTO algorithm.
    The green status LEDs for each channel blinks on all iQUBE^2 CPU boards in the system (primary and secondary).

Note	*MS.AUTO places all iQUBE^2 boards in the system in a suspended state in which they are unresponsive to any commands. Once started, MS.AUTO can only be terminated by pressing the S1 switch, waiting for the algorithm to time out (approximately five minutes) or powering down the units.*

2.8.4   Push-Button Address Assignment

Once *MS.AUTO* has been started (all boards' channel status LEDs are blinking), the addresses for the secondary boards can be assigned.

Note	*If MS.AUTO has been set on the iQUBE^2 and it will be connected to a host device, upload the data from the iQUBE^2 to the host device. Ensure the master and secondary are configured, using the serial port menu go into the iQUBE^2 screen and connect to the iQUBE^2. Select upload to get data to host device.*

1. Press and release the **S1** button on the unit to be assigned as Secondary #1 (not the primary board). This registers its ID with the primary unit which then assigns it an address. The channel status LEDs on this board stop blinking. The status LEDs for all other boards in the system continue to blink.

2. Repeat Step 1 for Secondary Unit #2 and #3, as necessary.

3. Press and release the **S1** button on the primary iQUBE^2 once all secondary units have been assigned.

4. If using the hardware implementation method described above, store the assigned addresses into non-volatile memory by setting *SW1* to *OFF* on the primary iQUBE^2.

Note	*For accessibility, in enclosures that contain more than one iQUBE^2 board, the top board is typically the primary.*

2.8.5   Manual Assignment with Virtui2

Primary/secondary assignment is performed within the Device Configuration section of the Virtui2 Configuration Utility. Refer to Section 5.0 on page 45.

2.8.6   Restore System Defaults

System defaults can be restored by using EDP commands or manually resetting the iQUBE^2.

EDP Command	Explanation
RESETCONFIGURATION	Clears all parameters and all primary/secondary IDs and addresses.
RS	Resets the software to restart all processes in the core.
RESETDEFAULT	Resets all parameters to default, but leaves the primary/secondary IDs intact.

Table 2-12. Reset EDP Commands

Use the following procedure to manually reset the system to its default settings. This also resets addresses and IDs. To restore system defaults and retain addresses and IDs, use the *RESETDEFAULT* EDP command in Table 2-12.

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1. Ensure *SW1* is set to *CFG*.
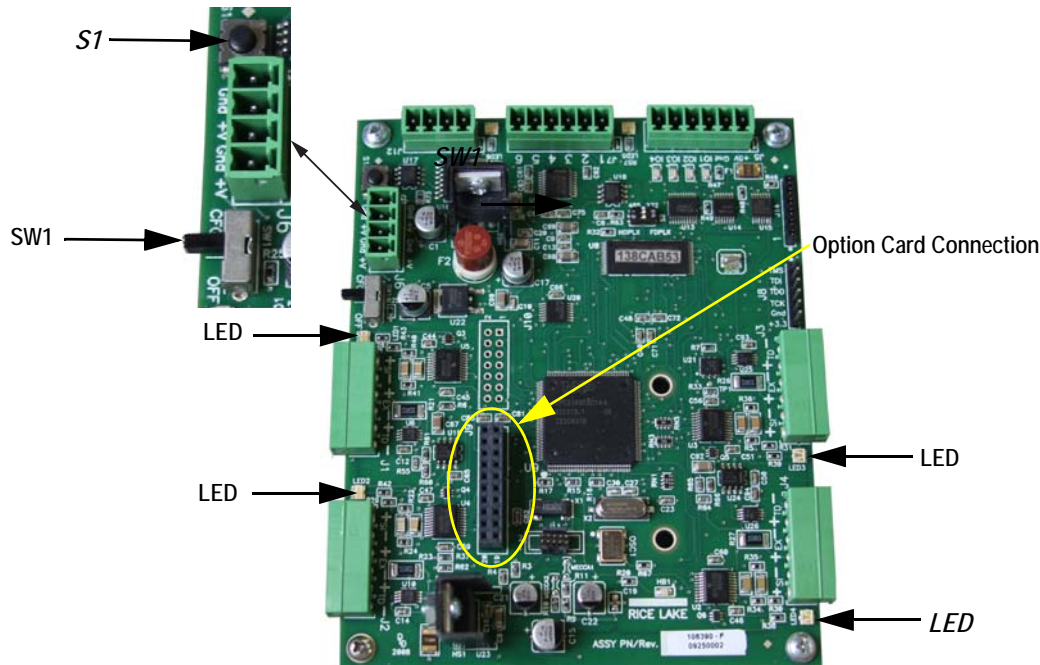
Figure 2-6. LED Lights Location

2. Press and hold **S1** until the LED lights blink 4-5 times and then remain a steady green.

> **Note** *If S1 is not held long enough, when released, lights flash red and then go out indicating the system has not been set.*

3. Set SW1 to OFF to overwrite stored system parameters with default values.

> **Note** *Power cycling the unit without overwriting stored parameters reloads stored parameters including previously assigned secondary board IDs and addresses.*

2.9   Installing Option Cards

Each option card is shipped with installation instructions specific to that card. Follow the general procedures for installation into the iQUBE[2].

> ⚠ **CAUTION** *Option cards are not hot-pluggable. Disconnect power to the iQUBE[2] before installing option cards.*

1. Disconnect the power to the iQUBE[2].
2. Loosen the top screws and remove the cover from the iQUBE[2].
3. Insert plastic standoffs, included with the option card, into the mounting holes in the CPU board.
4. Carefully align the option card connector with J9 on the CPU board (Figure 2-4 on page 9) and the standoffs.
5. Press down to seat the option card in the CPU board connector, then press to seat the standoffs in the option card mounting holes.
6. Make connections to the option card as required.
7. Use cable ties to secure loose cables inside the enclosure.

> **Note** *The iQUBE[2] automatically recognizes all installed option cards when the unit is powered on. No hardware-specific configuration is required to identify the newly installed card to the system.*

2.10   Transient Board

Transient protection boards are recommended on each end of a power supply run when an external DC supply is used, and on any power supply cables to secondary units where the secondary enclosure runs are longer than 75'. To replace a transient protection board (PN 101369) in the iQUBE[2] use the following instructions.

1. Disconnect the power to the iQUBE[2].
2. Loosen the top screws and remove the cover from the iQUBE[2].
3. Disconnect all cables attached to the power board/transient protector board.
4. Loosen the screws securing the mounting bracket to the enclosure.
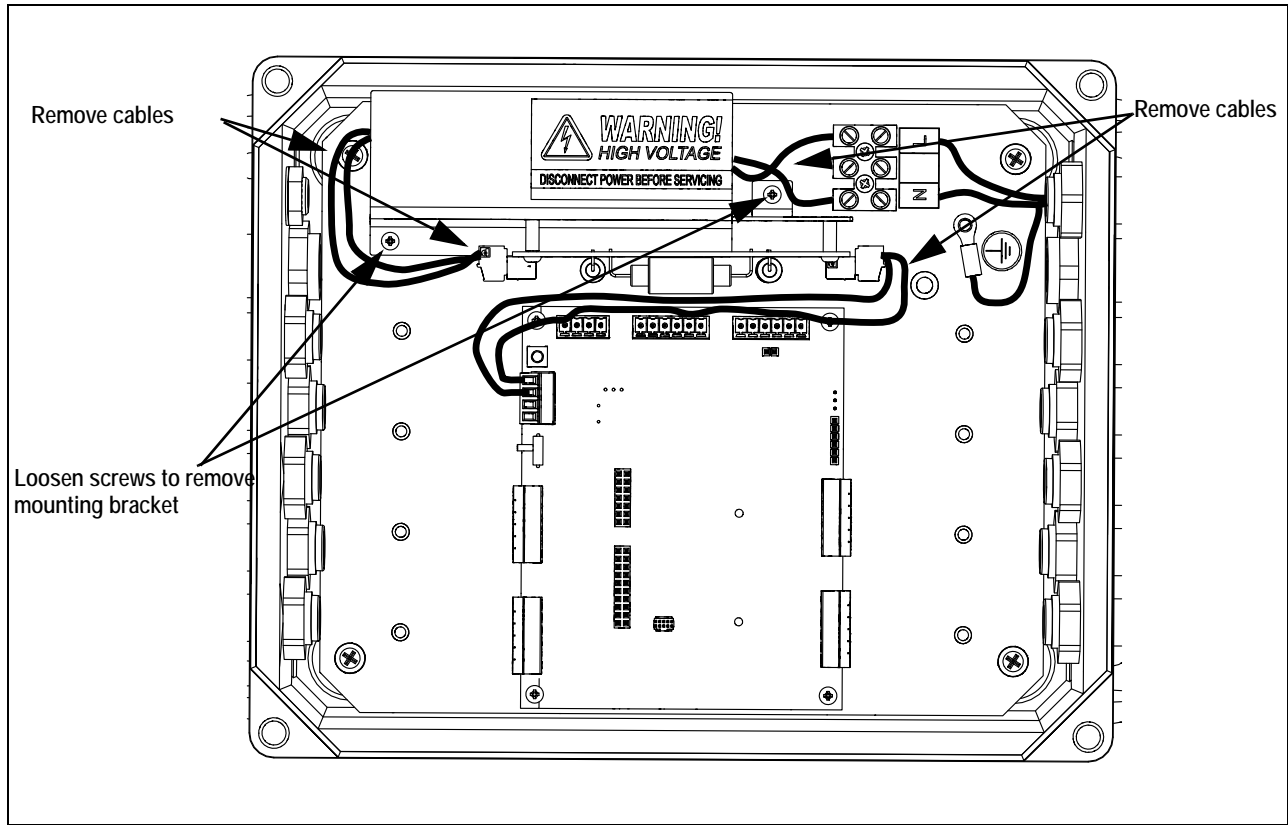
Figure 2-7. Disconnect Cables – AC Powered iQube[2] Shown

5. Loosen the screws to remove the transient protector board from the mounting bracket.
6. Align the new transient protection board with the standoffs on the existing mounting bracket and secure with the existing screws.

Note	*The transient protection board can be installed in either direction; the connectors are crossed over to prevent a connection error.*
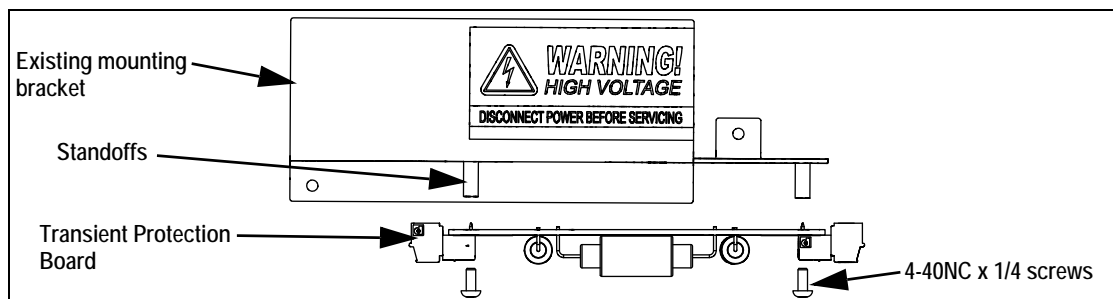
Figure 2-8. Replace Transient Board

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7. Reinstall the mounting bracket in the enclosure.
8. Connect the cables to the power board and transient protector board. See Figure 2-9.
   - Connect the power cable to the power supply.
   - Connect the cable from the power supply to the transient protection board (J1).
   - Connect the cable from the transient protection board (J2) to the CPU board (J6).
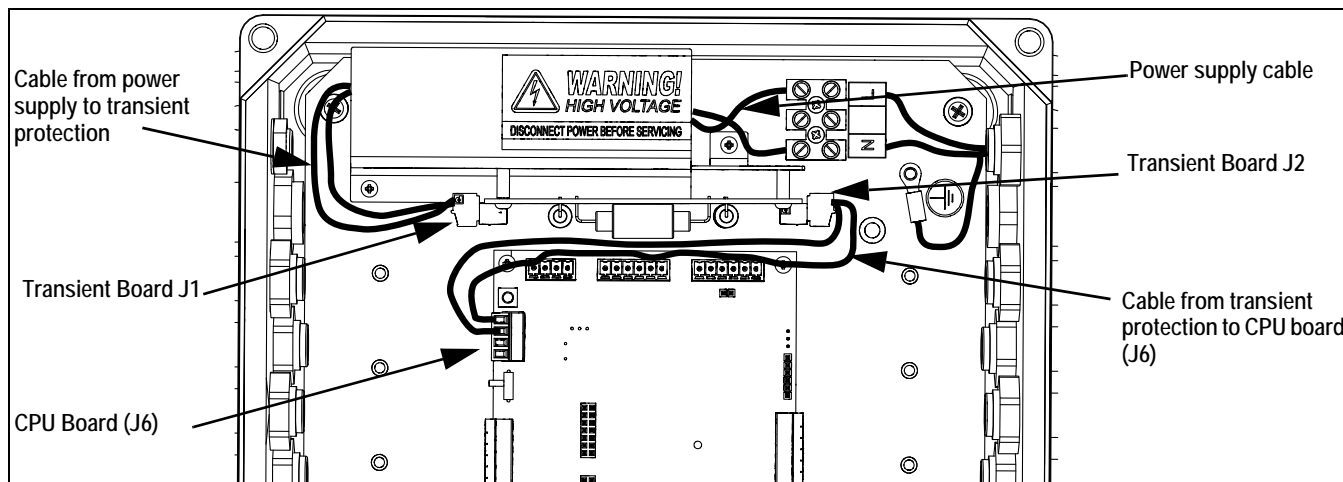
Figure 2-9. Connect Cables to Power Board and Transient Protector Board
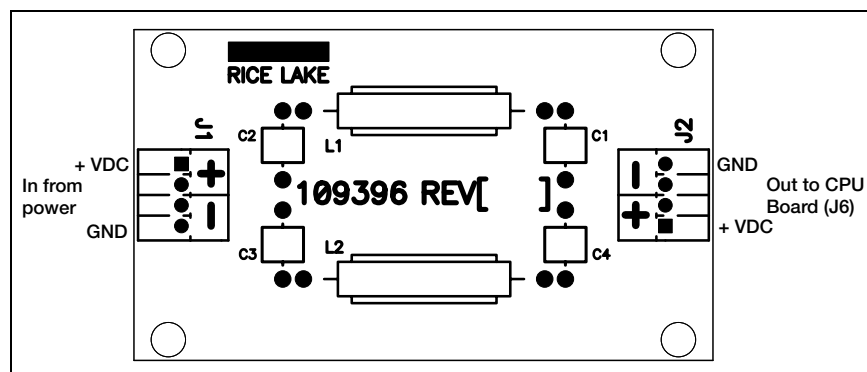
Figure 2-10. Transient Protection Board Wiring

9. Replace the enclosure cover.
10. Reconnect the power to the iQUBE[2].

> **Note** *See Addendum (PN 160051) for initial installation instructions.*

2.11 Parts Kit Contents

Parts kit contents for the 4- and 8-channel models of the iQUBE[2].

PN	Description	Quantity 4-ch	8-ch
14861	Machine screws, 8-32NC x 3/8	8	12
15134	Lock washers, No. 8 Type A	8	12
15631	Cable ties, 3-in.	5	5
15665	Reducing glands, 1/2 NPT	2	2
19538	Slotted posts, 1/4 x 1	8	10
53075	Ground cable clamps	8	12
66730	Ferrite EMI suppression filters	4	8
76513	4-position screw terminal connector	1	2
76514	6-position screw terminal connectors	6	12
94422	Capacity label	1	1
108435	iQUBE[2] Toolkit CD	1	1

Table 2-13. Parts Kit List

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2.12 Replacement Parts
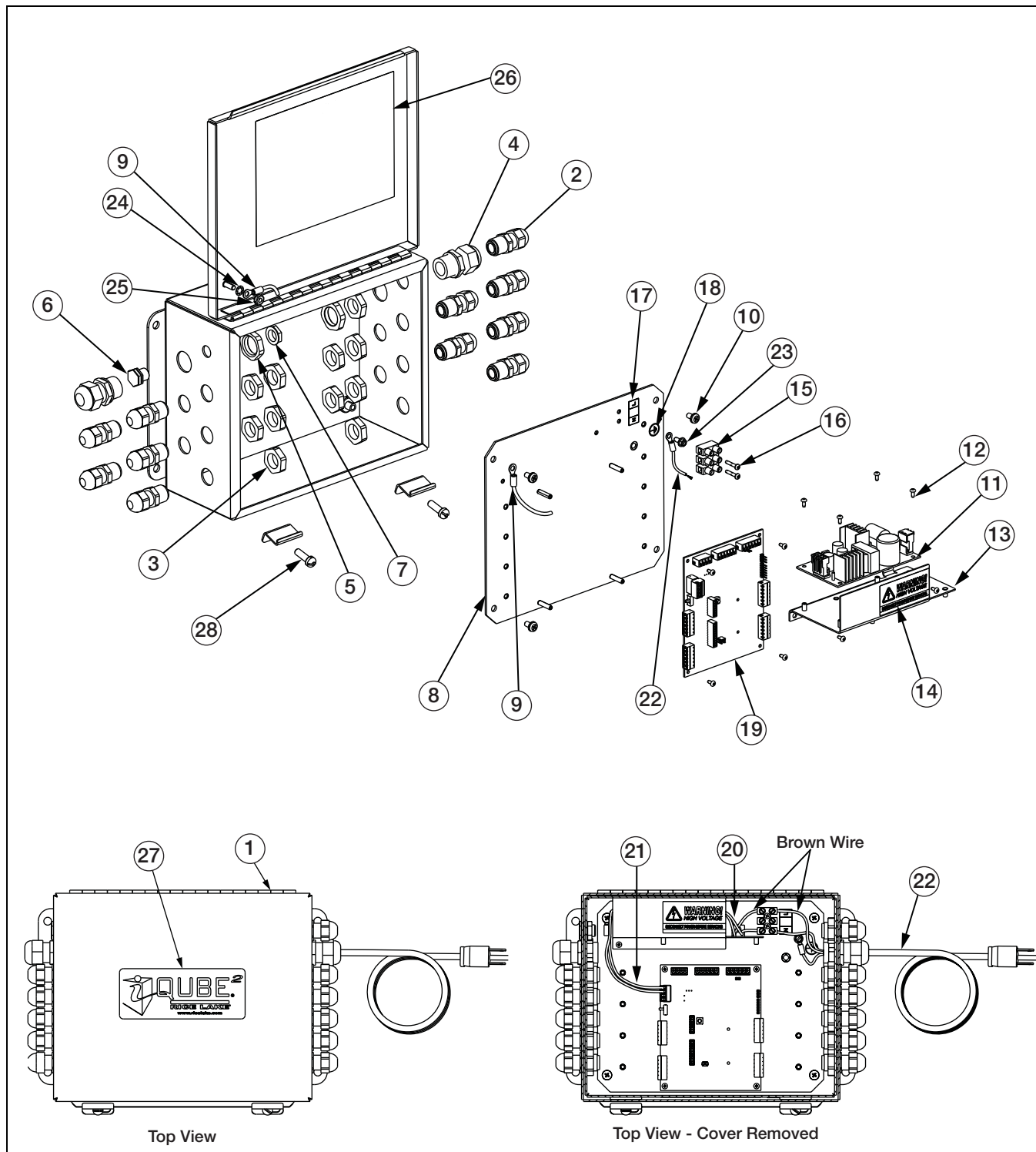
Figure 2-11. iQube² Parts Illustration

Ref Number	PN	Description (Quantity)	Qty
1	106389	10 x 8 x 4 stainless steel enclosure	1
	106388	Large FRP enclosure	1
	109528	Small FRP enclosure	1
	81268	O-rings (4-FRP enclosures only)	4
2	15655	Cord grips, 3/8 NPT (11-small; 17-large)	11/17
3	15656	Lock nuts, 3/8 NPT (11-small; 17-large)	11/17
4	15628	Cord grips, 1/2 NPT	2
5	15630	Locknuts, 1/2 NPT	2
6	88733	Breather vent	1
7	88734	Breather vent nut	1
8	106391	Component plate, small enclosure	1
	109153	Component plate, large enclosure	1
9	109446	Ground wire, 9-in	1
10	109526	Machine screws, 10-32NC x 3/8	4
11	76556	Switching power supply	1
12	14825	Machine screws, 4-40NC x 1/4 (10-small; 12-large)	10/12
13	107026	Power supply mounting bracket	1
14	16861	High voltage warning label	1
15	44744	3-position terminal block	1
16	14834	Machine screws, 4-40NC x 5/8	2
17	109319	AC power connection label	1
18	16892	Earth/ground label	
19	106390	iQUBE[2] CPU board	1
20	109142	AC input cable assembly	1
21	109145	CPU board power cable assembly	1
22	109581	Power cord assembly, 120VAC	1
23	109529	Machine screw, 8-32NC x 3/8	1
24	15140	Lock washer, No. 10 Type A	1
25	14632	Kep nut, 10-32NF hex	1
26	109344	iQUBE[2] connection label	1
27	109343	iQUBE[2] label	1
28	71455	Machine screws, 1/4-28NF x 3/4	2
	85791	Main power supply fuse, 2.5 amp 5x20mm	
	80869	CPU board fuse	
	1122262	Refresh cable	
⚠ CAUTION		*Replace fuses only with fuses of the same type and rating to protect against the risk of fire.*	

Table 2-14. Replacement Parts

3.0   1280 Configuration

This section describes configuration for the iQUBE[2] using the 1280. Instructions in this section assume that the configuration application is installed on the PC, and that the load cell and communications wiring between multiple iQUBE[2] boards, if applicable, and between the iQUBE[2] and the PC is complete.
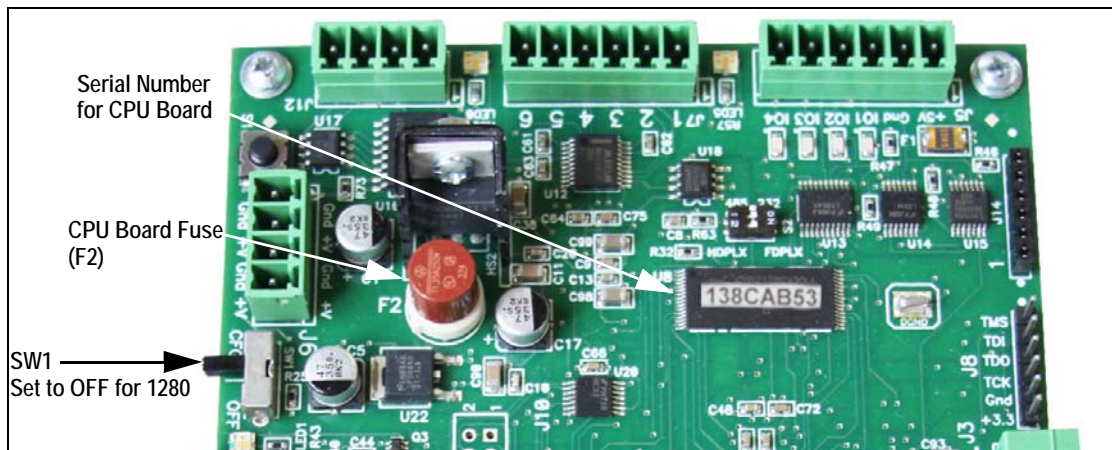
Figure 3-1. SW1 Location on CPU Board

3.1   Configuration

Set the *Scale Kind* to iQUBE[2]. See the 1280 Technical Manual (PN 167659) for more information on scale setup.
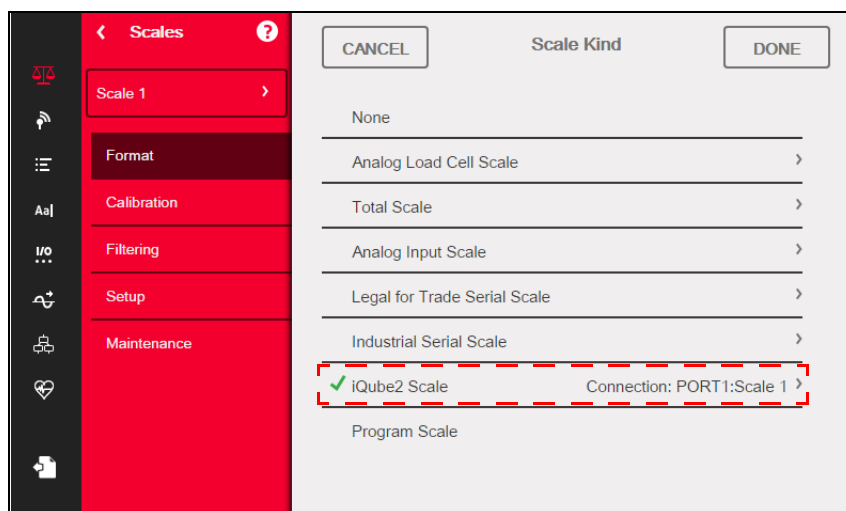
Figure 3-2. 1280 Scale Kind

> **Note**   *Settings can be made to the iQUBE[2] prior to setting the scale kind; however, the 1280 must be set to the iQUBE[2] scale kind before it can be used.*

3.1.1 iQUBE² Setup

Popup – enter iQUBE² setup
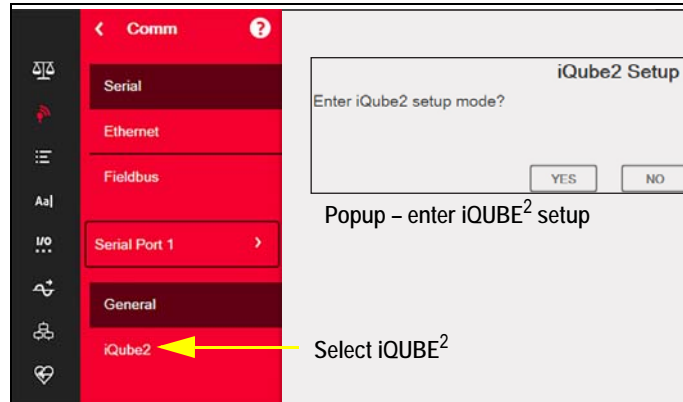
Select iQUBE²

Figure 3-3. 1280 Communication Menu

1. From the *Communication Menu* on the 1280 select iQUBE². A popup displays, asking to enter iQUBE² setup mode.
2. Press YES to enter setup. The iQUBE² Setup menu is displayed.
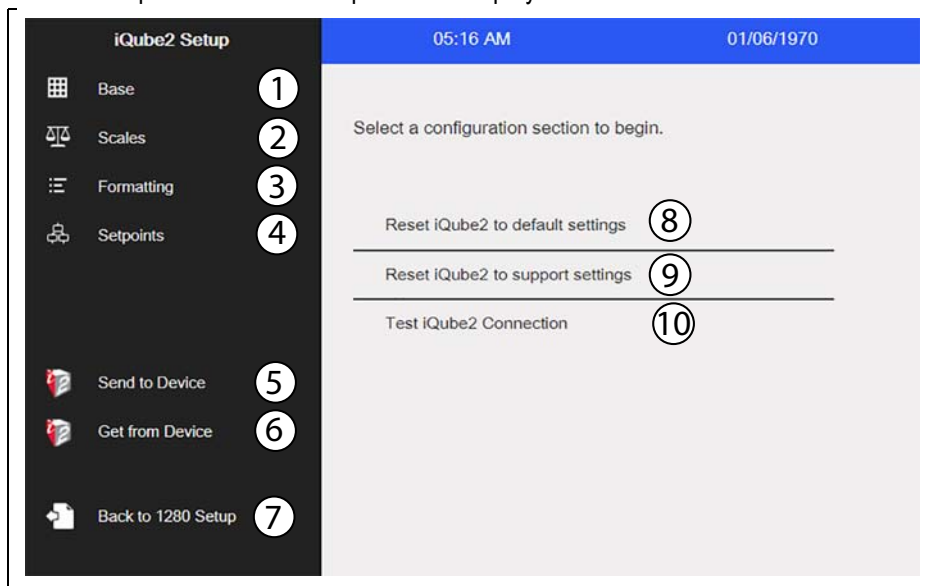
Figure 3-4. 1280 iQUBE² Setup Menu

Item No.	Description
1	Base – used for assignment of board ID's, time and date format, load cell settings and assignment, ports and digital I/O setup and diagnostics
2	Scales – used for the setup of scale information required for iQUBE² operation
3	Formatting – used to set print and stream formats, up to six formats may be set
4	Setpoints – used to setup four setpoints to work with the iQUBE²
5	Send to Device – used to send configuration and calibration settings to the iQube2
6	Get from Device – used to upload configuration settings from the connected iQube2 and to replace the current iQube2 configuration settings within the 1280
7	Back to 1280 Setup – Returns the display to the 1280 setup screen
8	Resets all iQube2 settings to default values within the 1280. Requires a *Send to Device* if resetting the iQube2 to default values is desired.

Table 3-1. Setup Parameters

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Item No.	Description
9	Resets all iQube2 settings to default values within the 1280, with the exception of the primary/secondary board ID's and Addresses. Requires a *Send to Device* if resetting the iQube2 to default values is desired.
10	Verifies that a connection to the iQube2 board can be made.

Table 3-1. Setup Parameters (Continued)

> **Note** During setup for all parameters, select CANCEL to leave the current parameter without saving.

3.2 Base Setup

Select Base ▦.
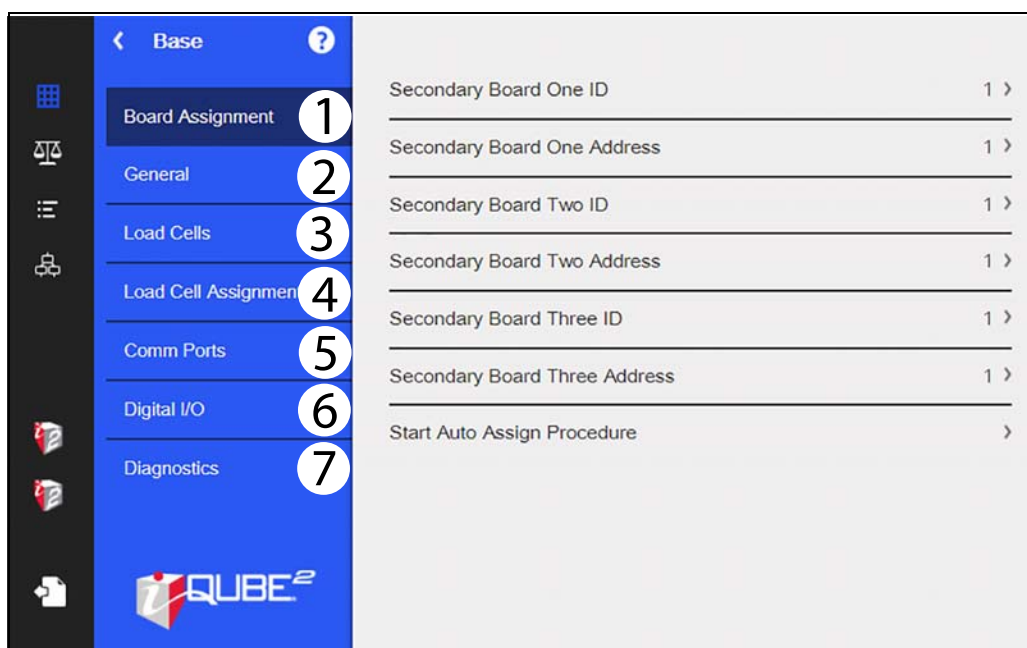
Figure 3-5. iQUBE² Base Menu

Item No.	Description
1	Board Assignment – set the secondary boards, one through three, with IDs and addresses (See Section 3.2.1 on page 23)
2	General – set the date/time format and separator and the update rate (Section 3.2.2 on page 24)
3	Load Cells – select load cell and setup load cell parameters (Section 3.2.3 on page 24)
4	Load Cell Assignment – select scale and assign load cells (Section 3.2.4 on page 25)
5	Comm Ports – select ports and setup port parameters (Section 3.2.5 on page 26)
6	Digital I/O – select digital I/O and set parameters (Section 3.2.6 on page 26)
7	Diagnostics – select diagnostics to diagnose various parameters (Section 3.2.7 on page 28)

Table 3-2. Base Parameters

3.2.1 Board Assignments

Set the board IDs and addresses.

1. Select *Board Assignment*.
2. Select the board to assign. A keypad displays.
3. Enter the appropriate ID or address on the displayed keypad.

4. Press [DONE] after each parameter is set.

5. Repeat Steps 3-4 until all settings are complete.

Start Auto Assign Procedure can also be selected for automatic assignment.

3.2.2 General

Parameter	Default	Description
Warmup Delay	6	Select a time in seconds to warm unit up
Sample Rate	30 Hz	Select a sample rate in HZ – 2.5, 5, 10, 15, 25, 30, 50, 60, 100, 500
Date Format	MMDDYY	Select a format – MMDDYY, DDMMYY, YYMMDD, YYDDMM
Date Separator	Slash (/)	Select a date separator – Slash (/), Dash (-), Semi-colon (;)
Time Format	12 Hour	Select 12 hour or 24 hour
Time Separator	Colon (:)	Select a time separator – Colon (:) or Comma (,)

Table 3-3. General Parameters

To set the parameters described in Table 3-3:

1. Select a parameter to update. The settings menu displays.

2. Select the desired setting.

3. Press [DONE] after each parameter is set.

3.2.3 Load Cells

Parameter	Description
Name	Enter desired name
Serial Number	Enter the load cell serial number
Capacity	Enter the full capacity of the load cell
Zero Value	Enter zero value of load cell.
Factory Sensitivity	The factory supplied mV/V sensitivity of the connected load cell. Used for Theoretical Calibration only.
Normalization Value	The trim factor is used to trim the load cells during section and corner calibration and tweaking

Table 3-4. Load Cell Parameters

To set parameters for the load cells:

1. Select *Load Cells*.

2. Select the load cell from the drop down list.

3. Select each parameter and enter the required information.

4. Press [DONE] after each parameter is set.

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3.2.4   Load Cell Assignments
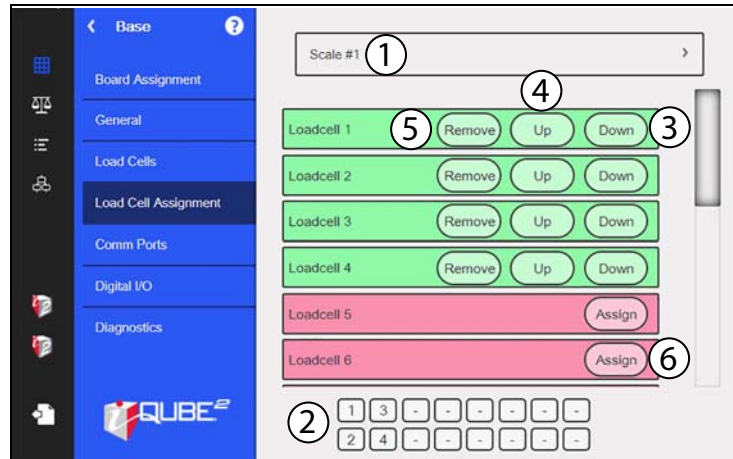
Figure 3-6. Load Cell Assignment Display

Item No.	Parameter	Description
1	Scale Selection	Use the drop down arrow to select the scale
2	Load Cell Location	Illustrates the position of the load cells. These can be changed by using the load cell buttons
3	Down Button	Move the load cell down in the load cell
4	Up Button	Move the load cell up in the load cell order. The up button moves the load cell down in the list/order but it may move the load cell up or to the left within the graphical load cell layout depending on its starting position.
5	Remove Button	Remove the load cell from the selected scale
6	Assign Button	Assign the load cell to the selected scale

Table 3-5. Load Cell Assignment

3.2.5 Comm Ports

Parameter	Default	Description
Baud Rate	115200	Selects the transmission speed for the port
Data Bits/Parity	8-None	Selects number of data bits transmitted or received by the port. Sets **parity bit to odd**, **even or none**
Line Termination	CR/LF	Selects termination character for data sent from the port
Response Delay	2 ms	
Checksum	Off	
Stop Bits	1	Selects the number of stop bits transmitted or received by the port
End of Line Delay (seconds)	0	Sets the delay period from when a formatted line is terminated to the beginning of the next formatted serial output Range acceptable is 0.0-25.5 seconds
RS485 Address	0	
Command Echo	On	Specifies whether characters received by the port are echoed back to the sending unit
Streaming Checksum	Off	
Streaming Prefix	0	
Streaming Postfix	0	
Polling Checksum	Off	
Polling Prefix	2	
Polling Postfix	3	

Table 3-6. Communication Parameters

To set the communication ports:

1. Select *Comm Ports*.
2. Select a comm port from the drop down list.
3. Select each parameter and enter the required information.
4. Press [DONE] after each parameter is set.

3.2.6 Digital I/O

The Digital I/O menu is used to assign functions to digital inputs and outputs.

To set the Digital I/O input and output:

1. Select *Digital I/O*.
2. Select a digital I/O from the drop down list.
3. Select *Function* and set digital I/O desired function.
4. Select *Source* and set to on of off.
5. Press [DONE] after each parameter is set.

Function	Description
Off	Indicates the bit is not configured
Output	Assign the bit as a digital output for setpoint or iRite program use
Input	Assign the bit as a digital input used for Digital Input setpoints
Programmability	Assign the bit as a digital input used to generate a iRite program event
Zero	Provides the same function as the front panel Zero key
Gross/Net	Provides the same function as the front panel Gross/Net key
Tare	Provides the same function as the front panel Tare key

Table 3-7. Digital I/O Functions

Function	Description
Units	Provides the same function as the front panel Units key
Print	Provides the same function as the front panel Print key
Accumulate	Add the current scale weight to the accumulator, if enabled
Clear Accumulator	Clear the accumulated value for the current scale, if enabled
Setpoint	Provides the same function as the Setpoint softkey
Time/Date	Provides the same function as the Time/Date softkey
Display Tare	Display the current scale tare, same function as the the Display Tare softkey
Clear Key	Provides the same function as the front panel Clear key
Cancel Key	Provides the same function as the Cancel softkey
Numeric Keys 0-9	Provides the same functions as the front panel numeric keys
Decimal Point Key	Provides the same function as the front panel Decimal Point key
Enter Key	Provides the same function as the front panel Enter key
Navigate Up	Provides the same function as the front panel Up Arrow key
Navigate Down	Provides the same function as the front panel Down Arrow key
Navigate Left	Provides the same function as the front panel Left Arrow key
Navigate Right	Provides the same function as the front panel Right Arrow key
Keyboard Lock	Lock the front panel keyboard while the input is active
Hold	Hold the current scale weight display while this input is active
Batch Run	Batch Run must be held active for a batch to start or run. If made inactive while a batch is running, the batch stops and remains at the current step. If it is not defined, a batchl starts anytime the Batch Start softkey is pressed, the Batch Start digital input is activated or a Batch Start serial command is received.
Batch Start	Start a batch from the current step if a Batch Run digital input is either active or not defined. If a Batch Run digital input is defined and inactive, Batch Start resets the batch to the first step.
Batch Pause	Pause a batch while the input is held active and turns off all digital outputs except those associated with Concurrent and Timer setpoints. Processing is suspended until the BatchPause input is made inactive.
Batch Reset	Stops an active batch and resets the current step to the first batch step. All digital outputs associated with batch setpoints are deactivated. If a batch is stopped or paused, Batch Reset will reset the current step to the first step.
Batch Stop	Stop an active batch and turn off all associated digital outputs. Requires a Batch Start to resume processing.
Clear Consecutive Number	Reset the consecutive numbering to the value specified in Consecutive Number Start
Gross	Set current scale to display gross weight
Net	Set current scale to display net weight
Primary Units	Set current scale to display in primary units
Secondary Units	Set current scale to display in secondary units
Tertiary Units	Set current scale to display in tertiary units
Clear Tare	Clear the tare value of the current scale
Cell Health	Indicates the health of the load cell
Host Control	Not supported in the 1280 - version 1.07

Table 3-7. Digital I/O Functions (Continued)

3.2.7 Diagnostics
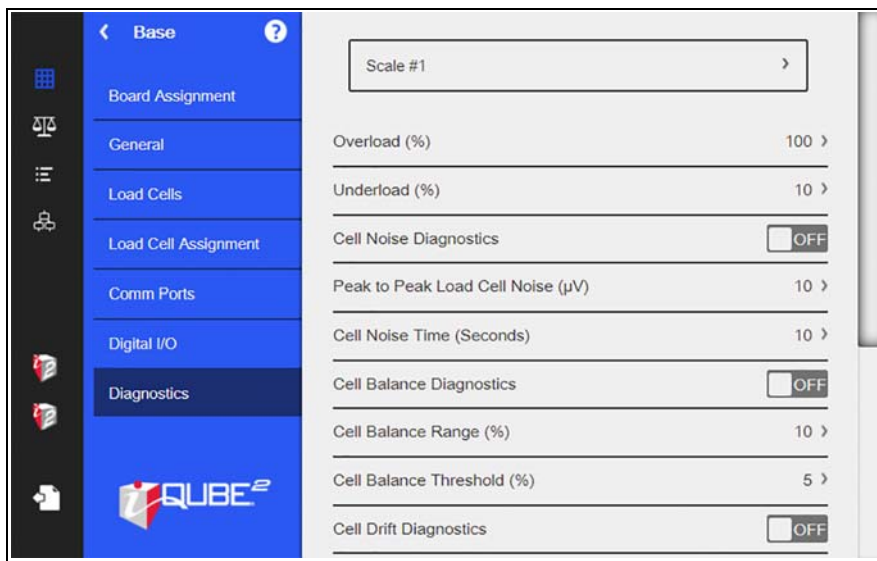
Figure 3-7. iQUBE² Diagnostics Menu

Function	Description
Overload	Overload point (% of capacity)
Underload	Underload point (% of capacity)
Cell Noise Diagnostics	Off or on
Peak to Peak Load Cell Noise	Sets peak to peak noise threshold for all scales (in μV)
Cell Noise Time	Sets peak to peak noise timer (seconds)
Cell Balance Diagnostics	Off or on
Cell Balance Range	Sets load cell balance range (% of capacity)
Cell Balance Threshold	Sets load cell balance threshold (% of capacity)
Cell Drift Diagnostics	Off or on
Cell Drift Thesh old	Sets load cell drift threshold (% of capacity)
Cell Drift Range	Sets load cell drift range (% of capacity)
Cell Drift Time	Sets load cell drift timer (seconds)
Zero Reference Diagnostics	Off or on
Zero Reference Threshold	Sets zero reference threshold (% of capacity)
Zero Reference Range	Sets zero reference range (% of capacity)
Zero Reference Time	Sets zero reference timer (seconds)

Table 3-8. Diagnostics Descriptions

3.3   Scales

Select Scales ⚖️.

Press the drop down arrow to select a scale to setup.
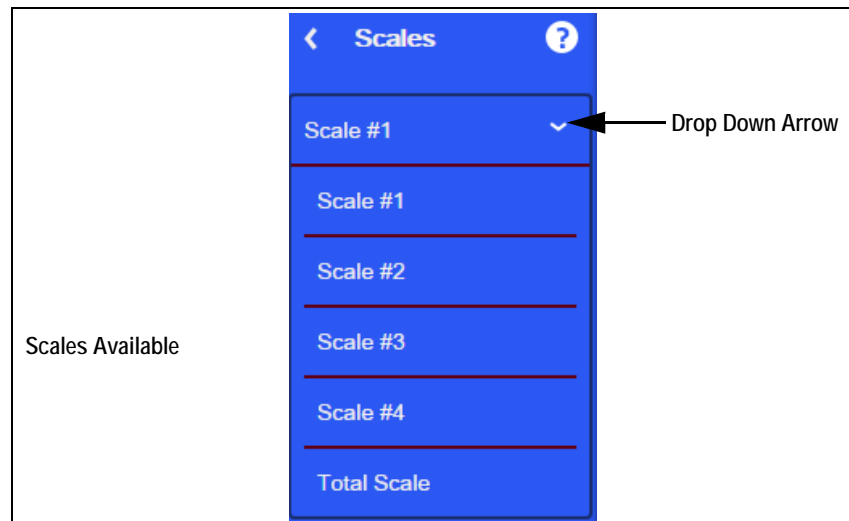
Figure 3-8. Select Scale

Parameter	Default	Description
Name	SCALE#1	Enter a different name for the scale using the displayed keyboard
Unit Id	1	Specifies the unit identification number with an alphanumeric value (1-9999999)
Graduations	6000	
Motion Band	1	Set the level (0-100 display divisions) at which scale motion is detected. If motion is not detected for the standstill time or longer, the standstill icon displays. If set to 0, the standstill icon is on at all times and operations including zero, print, and tare are performed regardless of scale motion. If set to 0, it is not Legal for Trade certified
Zero Track Band	0	For small weight changes around zero (0-100 display divisions), the zero track band is the value that can automatically be tracked off to return the scale to zero
Zero Range	1.9	Zero range (0-100) specifies the percent of capacity at which the scale can be zeroed
Regulatory Mode	NTEP	NTEP – is a regulatory agency that serves most of the United States
	OIML	OIML – is a global intergovernmental organization that publishes legal metrology recommendations for the regulatory agencies of its members
	Canada	Measurement Canada – is a regulatory agency that serves Canada
	None	Regulatory mode has not been chosen
Tare Function	Both	Both, Push Button Tare, Keyed, No Tare
Overload Range	Full Scale + 2%	Determine the value, in a percentage/display division above capacity, in which the display blanks and the out-of-range error message is displayed
Consecutive Number	0	Value is incremented following each print operation that includes <CN> in the ticket format. When reset, it is set to a value specified in the Consecutive Numbering Start parameter (0 to 9999999).
Consecutive Number Start	0	Start value of the next print when it is reset. Range is from 0 to 9999999.

Table 3-9. General Parameters for Scales

To set the general scale settings:

1. Select a scale (#1-#4 or Total Scale) from the drop down list.

2. Select *General*.

3. Select each parameter and enter the required information.

4. Press DONE after each parameter is set.

3.3.1   Filtering

Parameter	Default	Description
Filter Sensitivity	Heavy	Control the stability and response time of the scale • Heavy – results in an output that is more stable, but settles slowly. Small changes in weight data (a few grads) on the scale base are not seen as quickly • Medium – has a quicker response time than heavy, but more stability than light • Light – fastest response to small weight changes, but less stable
Filter Threshold	10	Digital filter cutout threshold (in display divisions). A weight change exceeding the threshold resets the filtered values. Must be set above the noise disturbances in the system. If set to zero, the filter is disabled.

Table 3-10. Filtering Parameters

To set the filtering.

1. Select *General*.

2. Select *Digital Filter Sensitivity* and set to *Heavy*, *Medium* or *Light*. See Table 3-10.

3. Select *Digital Filter Threshold* and set to desired number (0-2500).

4. Press [DONE] after each parameter is set.

3.3.2   Formatting

Parameter	Default	Description
Decimal Position	888888	88800, 888880, 888888, 88888.8, 8888.88, 888.888, 88.8888,8.88888
Units	Pound (lb)	lb, kg, g, oz, tn, t, none
Display Divisions	1	1, 2, 3

Table 3-11. Formatting Parameters

To select the format,

1. Select *Formatting*.

2. Select Primary or Secondary from the drop down menu.

3. Select Decimal Position

3.3.3   Communications

Parameter	Default	Description
Gross Print Format	FMT1	FMT1 through FMT6
Net Print Format	FMT2	FMT1 through FMT6
Print Destination	COM1	Off, COM Port 1, 2, 3, 1,2 1,3, 2,3 1,2,3
Stream Format	FMT4	FMT1 through FMT6
Stream Destination	Off	Off, COM Port 1, 2, 3, 1,2 1,3, 2,3 1,2,3

Table 3-12. Communication Parameters

To set the communications parameters:

1. Select *Communications*.

2. Select each parameter and enter the required information.

3. Press [DONE] after each parameter is set.

3.4   Formats

Identifier	Default Format
Format 1	Scale<SC><POL><W7.F><T7.><UNIT>
Format 2	Scale<SC>:<CR><LF>Gross<TAB><G><CR><LF>Net<TAB><N><CR><LF>Tare<TAB><T><CR><LF>
Format 3	<SC><POL><W7.><T7.><UNIT>
Format 4	<STX><POL><W7.><UNIT><G/N>
Format 5	<SC><POL><W7.><UNIT><G/N>
Format 6	<SC><POL><W7.><UNIT><G/N>

Table 3-13. Default Formats

To edit the formats:

1. Select *Formats*. Format 1-6 are displayed with default or last used format.
2. Select the *Format* to be edited. See Table 3-13. A keyboard displays.
3. Enter the new format using the displayed keyboard.
4. Press [DONE].
5. Repeat Steps 2-4 to edit formats as needed.

3.5 Setpoints

Setpoints can be configured to perform actions or functions based on specified parameter conditions.
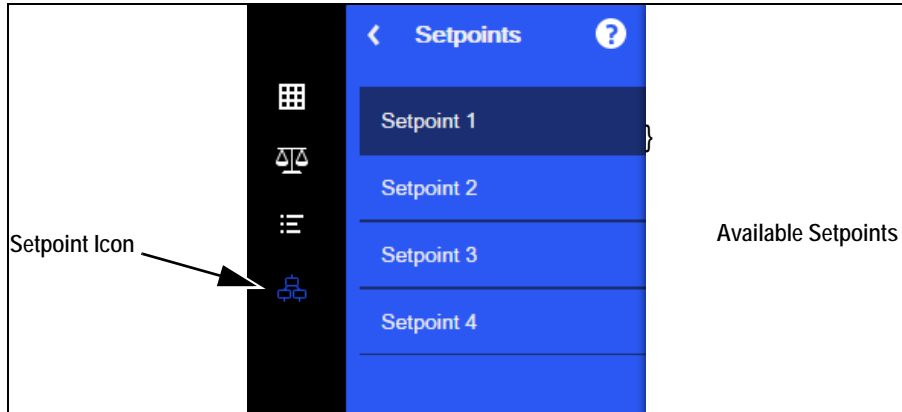
Figure 3-9. Setpoint Selections

Parameter	Description
Enable	Turn setpoints on or off
Kind	Select setpoint kind, see Table 3-15
Target	Set the value at which the setpoint trips.
Trip	Specify if the setpoint is satisfied when the weight is higher or lower than the setpoint value, within a band established around the value, or outside of that band. In a batch sequence with: • *Trip = Higher* – associated digital output is active until the setpoint value is exceeded. • *Trip = Lower* – output is active until the weight goes below the setpoint value. • *Trip = Inband* – setpoint is satisfied when the weight is within a band established around the value. • *Trip = Outband* – setpoint is satisfied when the weight is outside a band established around the value, excluding the value.
Band Value	When *Trip* is set to *Inband/Outband*, this specifies a weight equal to half the band width. The band established around the setpoint value is *Value ± Band Value*.
Hysteresis	When *Trip* is set to *Higher/Lower,* specifies a band around the setpoint value that must be exceeded before a setpoint that is off can trip on again.
Digital Output	Selects a digital output that is controlled by the setpoint

Table 3-14. Setpoint Parameters

To set the setpoints:

1. Press ![icon] (*Setpoint*).

2. Select *Enabled* to set the setpoint to On.

3. Select *Kind* to choose the kind off setpoints needed. See Table 3-15.

4. Press DONE .

5. Set the remaining parameters per the kind of setpoint selected.

6. Press DONE after each parameter is set.

Parameter	Description
Off	Setpoint turned off/ignored
Gross	Performs functions based on the gross weight; the target weight entered is considered a positive gross weight

Table 3-15. Setpoint Kinds

Parameter	Description
Net	Performs functions based on the net weight; the target weight entered is considered a positive net weight value

Table 3-15. Setpoint Kinds (Continued)

3.6   Calibration

Calibration types depend on how many load cells are connected to iQUBE[2]. If only one load cell is connected, only 2-point calibration is available.

The iQUBE[2] can be calibrated by using the Virtui2 Configuration Utility, host device front panel, or by serial commands. No minimum test weight values are required; however, at least 10% of the scale capacity is recommended.

Calibration Type	Description
2-Point	Traditional span calibration. No trimming will be done
Corner	Used when weight will be placed over each load cell
Section	Used when load cells are paired with each other and calibrated in those pairs
Theoretical	Mathematically calibrates the scale using full scale capacity and load cell sensitivities
Multi-point	Traditional span calibration, plus up to five linearity points. No trimming will be done.
Last Zero	Uses the last pushbutton zero in the system as the new zero reference point. Requires a span calibration. No trimming will be done
Temporary Zero	Used to calibrate non-empty scales. The difference between temporary zero and calibrated zero will be used as an offset. No trimming will be done.

Table 3-16. Calibration Types

4.0   920i Configuration

This section describes configuration for the iQUBE^2 using the 920i. Instructions in this section assume that the configuration application is installed on the PC and that the load cell and communications wiring between multiple iQUBE^2 boards (if applicable) and between the iQUBE^2 and the PC is complete.
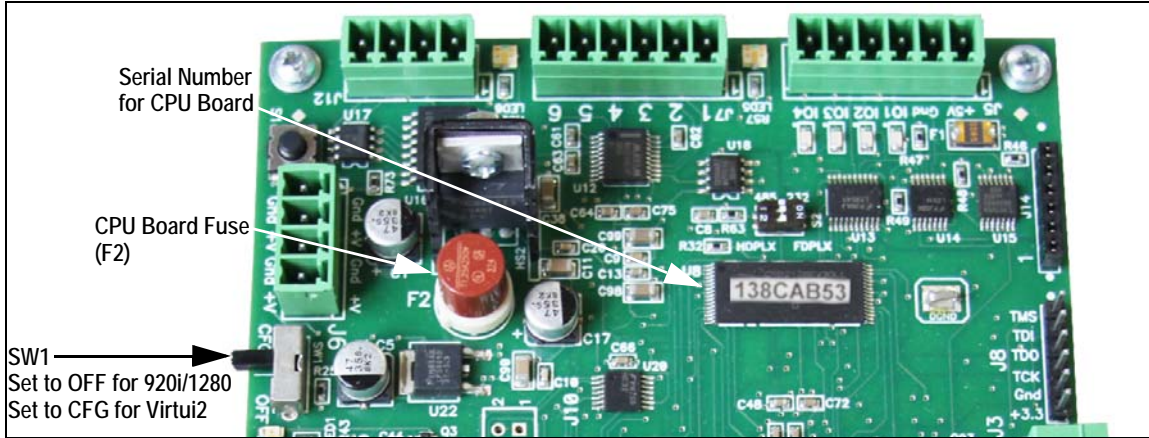
Figure 4-1. SW1 Location on CPU Board

4.1   Configuration
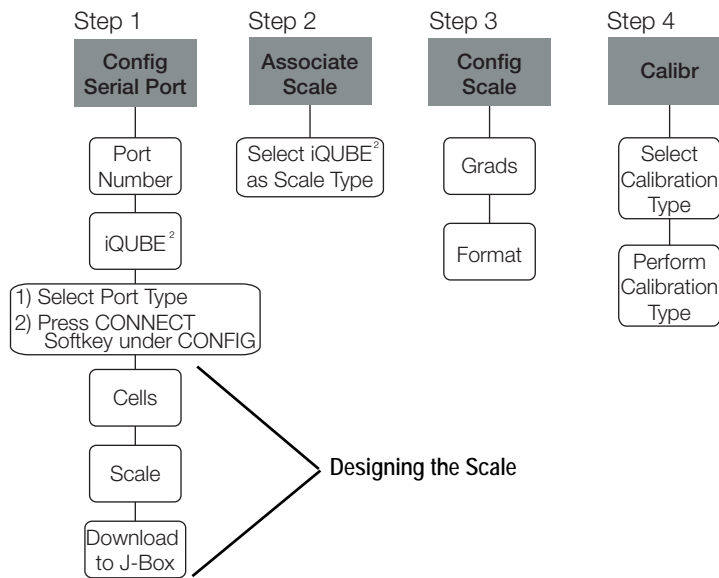
Figure 4-2. Basic iQUBE^2 920i Configuration Flow Chart

Place the 920i in setup mode to configure iQUBE^2. The setup switch is accessed by removing the fillister head screw on the desktop or universal enclosures. Insert a non-conductive object into the access hole to press the switch.

Once in setup mode, a series of menus display, with *Scale Configuration* underneath. Use the front panel keys to navigate through the series of configuration menus. See the 920i manual (PN 67887) for more information.

> **Note** *It is not necessary to move the iQUBE^2 SW1 switch. It should remain in the OFF position.*
> *Some iQUBE^2 parameters cannot be accessed through the 920i configuration menus. Use iRev for complete and efficient configuration interface for the 920i.*

When configuration is complete, press the Save and Exit softkey to exit setup mode. Replace the setup switch access screw.

> **Note** Save and Exit *writes all parameter changes to flash memory before returning to weigh mode in both iQUBE^2 and 920i.*
> *After parameter changes are complete, the configuration must be downloaded. See* Section 4.2 on page 39.

4.1.1 Connect to 920i

1. From the *SERIAL* menu, navigate to the *PORTTYPE* sub-menu and select the correct port type.

2. Navigate to the *CONFIG* menu and press the **Connect** softkey.

4.1.2 Manual Assignment with the 920i

1. Navigate through the *Serial* menu as shown in Figure 4-3.

```
┌─ SCALES ─┬─ SERIAL ─┬─ FEATURE ─┬─ PFORMT ─┬─ SETPTS ─┬─ DIG I/O ─┬─ ALGOUT ─┬─ VERS ─┐
                 │
              ┌──┴───┐
            ─┤ PORT 4 ├─
            ─┤ IQUBE2 ├─
            ─┤ CONFIG ├─
              │ BOARDS │
        ┌─ 4 ─┬─ 1 ─┬─ 2 ─┬─ 3 ─┐
```
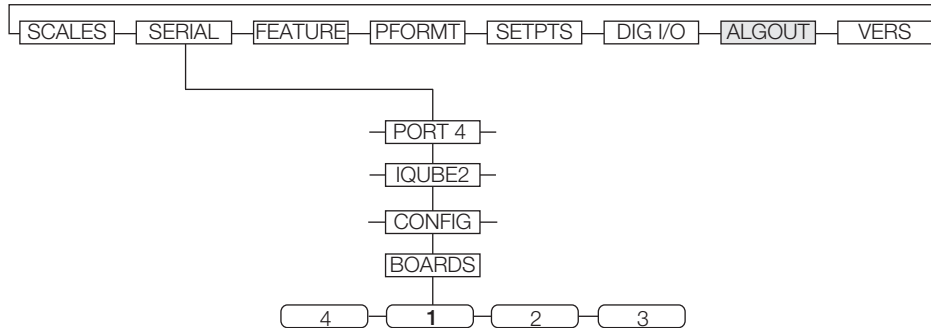
Figure 4-3. Boards Menu Selection

2. With the *Boards* menu selected, press the **AUTO ASSIGN** softkey and then follow Section 2.8.4 on page 14, Steps 1-3 to assign board addresses; or, press the **MANUAL ASSIGN** softkey to display an edit menu and manually assign the board addresses.

```
01/21/2010        10:21 AM

                                    Primary Board ID
Primary
                    —              ( 00000000 )

Secondary

  1)               65                12345678
  2)                —               ------------
  3)                —               ------------


        │ Auto Assign │ Done │ Edit │
```

Figure 4-4. Edit Menu

4.1.3   920i–iQUBE[2] Menu Configuration

Use the LEFT (◁) and RIGHT (▷) navigation keys to move between menu selections. Use the DOWN (▽) and UP (△) navigation keys to enter and exit menu selections. Use the **ENTER** key to specify a parameter selection.
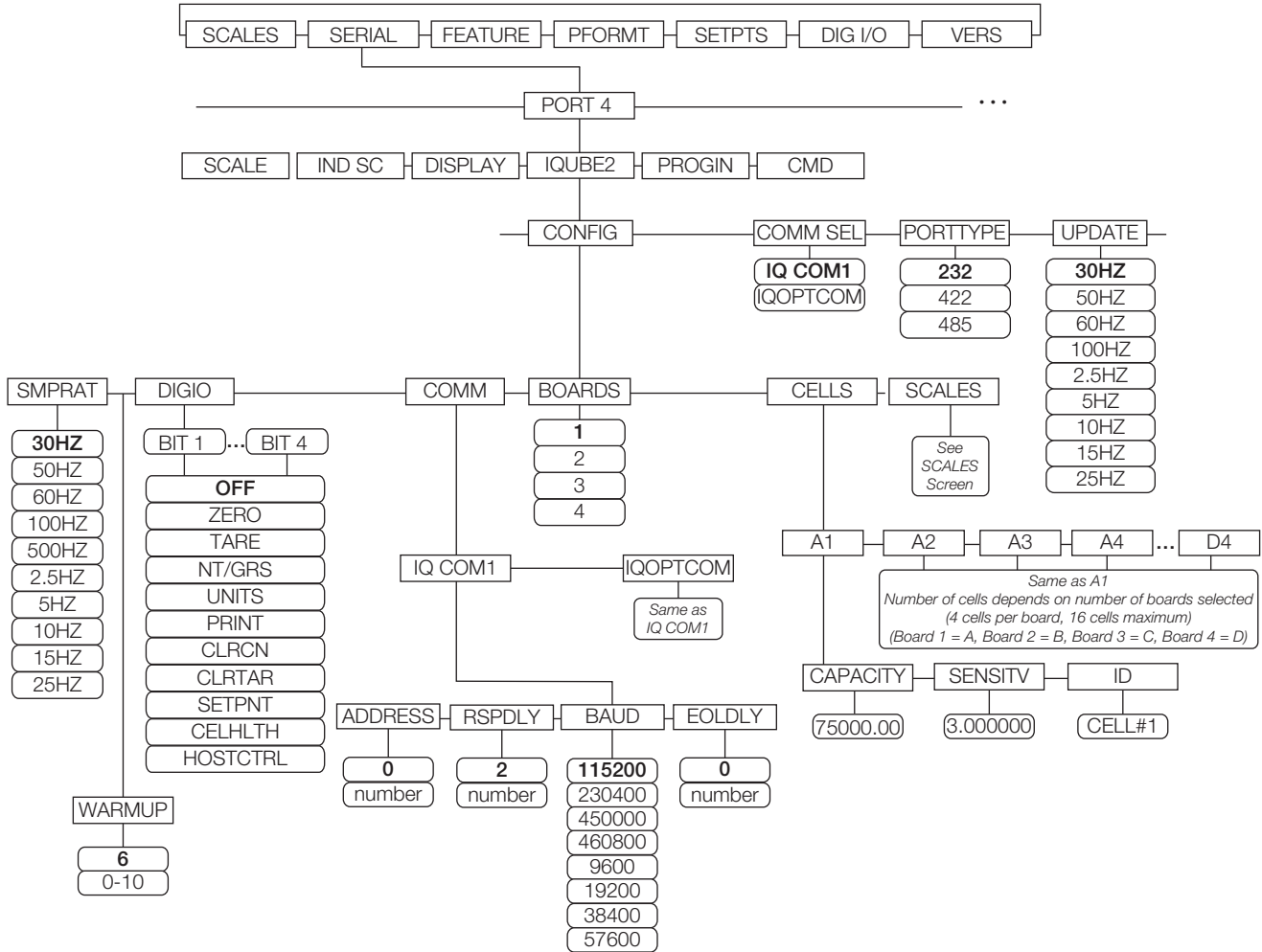
Figure 4-5. 920i Serial Menu

If there are multiple boards, they must be assigned. See .

Navigate through the *Serial* menu and select the iQUBE[2] to begin setup.

Parameter	Description
COMM SEL	Select **IQCOM1** (default) as the standard communications port or IQOPTCOM for option cards
PORTTYPE	Communication type for the selected port: RS-232 (default), RS-422, or RS-485
UPDATE	Measurement rate, in samples per second; **30HZ** (default), 50HZ, 60HZ, 100HZ, 2.5HZ, 5HZ, 10HZ, 15HZ, 25HZ
SMPRAT	Select measurement rate of the analog-to-digital converter, in samples per second; lower sample rates provide greater signal noise immunity; **30HZ** (default), 50HZ, 60HZ, 100HZ, 500HZ, 2.5HZ, 5HZ, 10HZ, 15HZ, 25HZ
WARMUP	The delayed response time (minutes) during warm-up; 1-10 minutes, **6** (default)

Table 4-1. Serial Menu iQUBE[2] Sub-menu

Parameter	Description
DIGIO	Specify the function of each of the digital I/O bits; BIT 1 - BIT 4; Use Revolution to configure parameters
	OFF indicates the bit is not configured
	ZERO, TARE, NT/GRS, UNITS, PRINT — provide the same functions as the five major front panel keys
	CLRCN reset the consecutive number
	CLRTAR clear the current tare for the active scale
	SETPNT designate the bit as a free-running setpoint within the iQUBE^2
	CELHLTH designate the bit to provide cell health information
	HOSTCTRL give the host control over the bit's function
COMM	Parameters for the communications option specified within the COMM SEL parameter; IQCOM1, IQOPTCOM
	IQCOM1 – Parameters for standard communications options.
	ADDRESS – Specify the RS-485 address, 0 (default); RS-485 communications can be specified for Port 4 and for odd-numbered expansion ports 5 and higher.
	RSPDLY – Set response delay (in milliseconds) for RS-422, 2-wire communication; Min value = 2 (default)
	BAUD – Select the baud rate (transmission speed) for the port; Selections: 115200, 230400, 450000, 460800, 9600, 19200, 38400, 57600
	EOLDLY – end-of-line delay time in 0.1-second intervals (10 = 1 second), from when a formatted line is terminated to the beginning of the next formatted serial output: range 0-255, 0 (default)
BOARDS	Number of CPU boards are connected to the iQUBE^2; 1-4
CELLS	Parameters to set capacity, sensitivity and ID number of each cell; the number of cells depends on the number of boards selected in the BOARDS parameter (4 cells per board, 16 cells maximum); A1-4 (Board 1=A), B1-4 (Board 2=B), C1-4 (Board 3=C), D1-4 (Board 4=D)
	CAPACITY (default) – enter the load cell's capacity
	SENSTV – enter the load cell's actual or nominal millivolt/volt sensitivity.
	ID – specify the load cell ID.
SCALES	Scale setup menu to associate available load cells with the scale; see Figure 4-6 on page 38

Table 4-1. Serial Menu iQUBE^2 Sub-menu (Continued)

RS-485/422 Connections to Host 920i

Table 4-2 and Table 4-3 show the connections needed for RS-485/422 communications between a host 920i and the iQUBE^2. 2-wire half duplex is available on Port 4 of the 920i. The 920i serial expansion card, PN 67604, must be installed in the indicator for 4-wire RS-485/422 communications with the iQUBE^2.

Note *RS-485 is an addressed protocol. RLWS recommends using RS-422 if there is only one iQUBE^2 system. See 920i setup for port type.*

920i Board J10 Connector (Port 4)		iQUBE^2 J7 Connector	
RS-422 Signal	Pin	Pin	RS-422 Signal
GND	1	1	GND1
RS-422 A	5	4	RS-485 A
RS-422 B	6	5	RS-485 B

Table 4-2. 2-Wire RS-422 Connections for 920i Host

920i Serial Option Board J2 Connector		iQUBE[2] J7 Connector	
RS-485 Signal	Pin	Pin	RS-485 Signal
RET	6	1	GND1
AR+	1	4	Tx+ Y
AR-	2	5	Tx- Z
AT-	3	3	Rx- B
AT+	4	2	Rx+ A

Table 4-3. 4-Wire RS-485 Connections for 920i Host

> **Note** **RS-485 is an addressed protocol. Rice Lake Weighing Systems recommends using RS-422, if there is only one *iQUBE*[2] system. See *920i* setup for port type.**

CONFIG Menu

1. Enter the *CONFIG* menu to select the iQUBE[2] board and cell configurations.

2. Enter the *CELLS* sub-menu to define load cell IDs, capacities, and factory sensitivity values (optional).

3. Enter the *Scale Setup* display. It is divided into three areas:

   - *Potential Scales* (center section): Highlight the scale to configure. Use ◁ to move to the *Available Scales* section.

   - *Available Cells* (left section): Use this section to assign cells to the system. Use △ and ▽ to highlight the desired cell. Press the **Add** softkey to assign the cell.

   - *Associated Cells* (right section): Lists cells that have been assigned to the scale. Added cells change the visual representation of the scale base shown at the bottom of the display. Make sure the location of the cells on the screen matches that of the cells on the actual scale to ensure diagnostic and trimming functions work correctly.
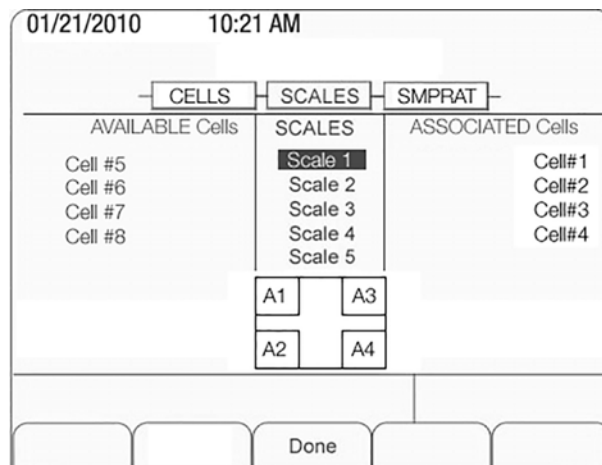

Figure 4-6. Scale Setup Menu

> **Note** *Scale 5 is the total scale. When it is highlighted, defined scales are available for summing.*

4. Press **Done** to accept the configuration.

5. Continue through the *CONFIG* menu to set the sample rate, digital I/O, and communications parameters.

Associating Digital I/O

1. Enter the *DIGIO* parameter to specify the function of each digital I/O bit. By default, Bits 1-4 are set to *OFF*. Higher number bits (secondary boards) are set to cell health by default and cannot be changed.

Note *Revolution III should be used to fully configure the parameters shown in Table 4-4.*

Parameter	Description
OFF	The bit is not configured.
ZERO	Provides the same function as the **ZERO** front panel key.
TARE	Provides the same function as the **TARE** front panel key.
NT/GRS	Toggles between net/gross mode.
UNITS	Provides the same function as the **UNITS** front panel key.
PRINT	Provides the same function as the **PRINT** front panel key.
CLRCN	Resets the consecutive number.
CLRTAR	Clears the current tare for the active scale.
SETPNT	Designates the bit as a free-running setpoint within the iQUBE^2.
CELHLTH	Assigns the cell health function.
HOSTCTRL	Gives control of the bit to the host.

Table 4-4. DIGIO Parameter Descriptions

4.2 Set COMM Parameters and Download Configuration

1. Enter the *COMM* parameter to set the iQUBE^2 baud rate, end-of-line delay (0-255, in 0.1-second intervals), and RS-485 address (not recommended for the 920i).

2. Connect to the 920i (see Section 4.1.1 on page 35).

3. When the entire iQUBE^2 configuration is complete, press the Download softkey under the *Configuration* menu.

Note *Serial configuration changes require downloading; however, changes made under the Scale menu are made in real-time at the iQUBE^2.*

4. Press △ and ▽ to select *Download iQUBE^2 configuration only*.

5. Press ENTER.

4.2.1 Associating a Scale

If the 920i isn't connected to the iQUBE^2, refer to Section 2.6 on page 10.

Note *Scale 5 is the total scale.*

1. Navigate to the *SCALES* menu on the 920i.

2. Press ▽ to display the CONFIG parameter.

3. Press ▽ to enter the *Scale Association* menu.

4. Press Change Type softkey to toggle through the columns:

   • *AVAILABLE IQUBES* (left section): highlight the desired port/scale combination and press the Add softkey to associate the iQUBE².

   • *SCALES* (center section): highlight the scale being configured. Use ◁ to move to the *AVAILABLE iQUBES* or ▷ to move to the *ASSOCIATED iQUBES*.

   • *ASSOCIATED IQUBES* (right section): lists iQUBE² scale that has been assigned to the 920i scale. Use the Remove softkey to remove the iQUBE² from the 920i association.
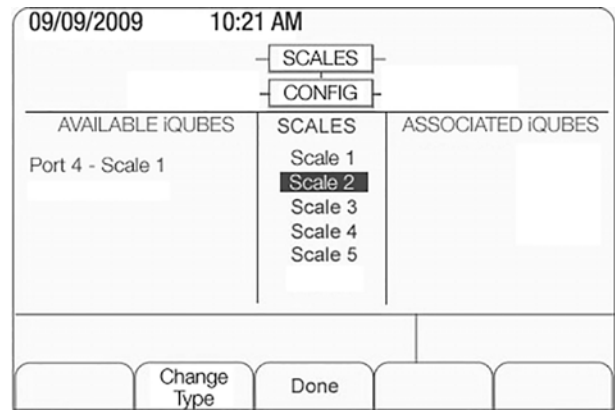

Figure 4-7. Scale Association Menu

> **Note** *Only one iQUBE² scale can be associated with a 920i scale. If the 920i scale is associated with another function, such as streaming or a setpoint, that association needs to be removed first.*

5. Press ▽ when all required iQUBE² scales have been assigned to the 920i scales.

4.2.2 Digital Filtering

Digital filtering can be used to create a stable scale reading in challenging environments. The iQUBE² uses an advanced adaptive filter which monitors scale statistics to control settling and response times for the desired scale stability setting. The iQUBE² has two parameters related to digital filtering which can be set: *sensitivity* and *threshold*.

Digital Filtering Sensitivity

Digital Filtering Sensitivity (*DFSENS*) controls the stability and settling time of the scale. The sensitivity parameter can be set to *Heavy*, *Medium*, or *Light*. A heavy setting results in an output that is more stable and settles more quickly than a light setting. Small changes in weight data (on the order of a few grads) on the scale base are not seen as quickly.

If the difference in subsequent weight values on the scale will be only a few grads, use a light setting. If the application is a truck scale where the changes in subsequent weight values will be on the order of 100s of grads, a heavy setting is more appropriate.

Digital Filtering Threshold

Digital Filtering Threshold (*DFTHRH*) controls the response delay time of a scale. This parameter can be set in the range of NONE to 15,000. When a new sampled weight value is acquired, the adaptive filter compares the new value to the previous (filtered) output value. If the difference between the new value and the previous output value is greater than the *DFTHRH* parameter (in counts) the adaptive filter output is disabled and the newly acquired sample value is used for the output.

If the difference between the new value and the previous output value is less than the *DFTHRH* parameter, the two values are averaged together using a weighted average based on the amount of the difference, the time the system has been stable, and the selected *DFSENS* value.

> **Note** *To disable filtering, set DFTHRH to none.*

4.3 920i Calibration

The calibration types available depends on how many load cells are connected to iQUBE^2. If only one load cell is connected, only 2-point calibration will be available.

The iQUBE^2 can be calibrated by using the Virtui2 Configuration Utility, 920i, or serial commands. No minimum test weight values are required; however, at least 10% of the scale capacity is recommended.

Calibration Type	Description
2-Point	Traditional span calibration. No trimming will be done.
Corner	Use when weight will be placed over each load cell.
Section	Use when load cells are paired with each other and calibrated in those pairs.
Theoretical	Mathematically calibrates the scale using full scale capacity and load cell sensitivities.

Table 4-5. Calibration Types

Verify that the iQUBE^2 is connected to the 920i with power applied. Use the 920i setup switch to make sure the indicator is in setup mode.

> **Note** *Do not move the iQUBE^2 SW1 switch. It should remain in the OFF position. If iQUBE^2 is not connected, menus may run slowly. Configuration must be downloaded prior to calibrating.*

> **IMPORTANT** *Do not mix calibration types (section, corner, 2-point). Span adjustments must be made in the appropriate calibration type.*
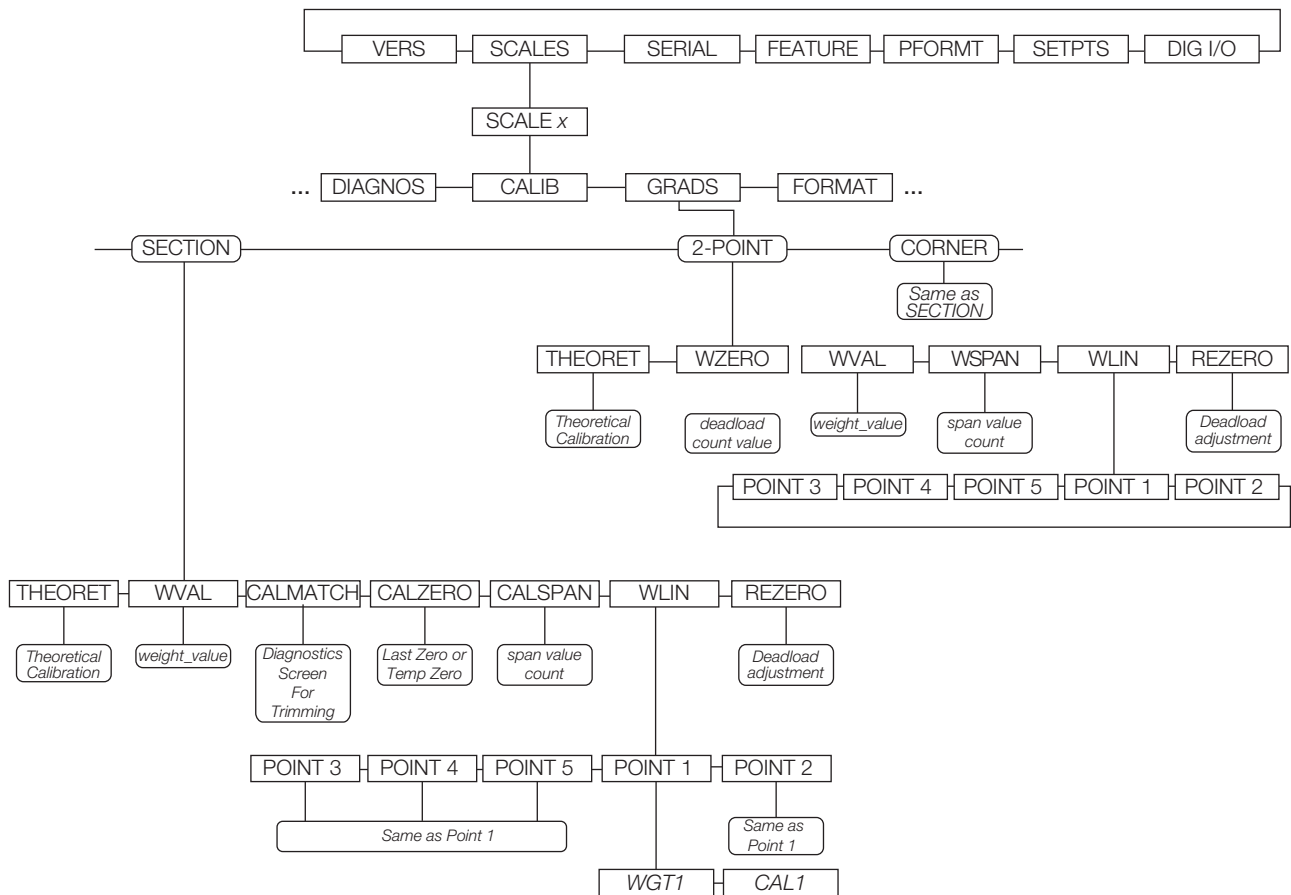
Figure 4-8. 920i Calibration Submenu

Level 4 Submenus	
Menu	Description
THEORET	Provides access to perform a theoretical calibration, which mathematically calibrates the scale using load cell sensitivities and setting full scale capacity based on the sum of the load cell capacities
WZERO	Provides access to perform a traditional zero calibration for a 2-point scale; Advanced options are also available See Section 4.3.2 on page 44.
WVAL	Provides access to display and edit the test weight value.
WSPAN	Provides access to display, calibrate and edit the traditional span calibration value for a 2-point scale.
CALZERO	Provides advanced options for specifying an alternative zero source for a Cal-Match® scale.
CALSPAN	Provides access to perform an optional, final span calibration on a trimmed scale.
WLIN POINT 1 - POINT 5	Provides access to test weight and calibration values for up to five linearization Provides access to test weight and calibration values for up to five linearization points. Perform linear calibration only after Zero and Span calibration points have been set. See Section 4.3.2 on page 44 for more information about linearization.
REZERO	Provides access to perform an optional, final zero calibration, which removes an offset value from the zero and span calibration values.

Table 4-6. CALIB Menu Parameters

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4.3.1 Front Panel Calibration

From the 920i front panel, a theoretical, 2-point, or Cal-Match calibration can be performed. Calibration is performed in real-time with each button press.

Theoretical Calibration

To perform a theoretical calibration:

1. Ensure the scale is empty and navigate to the *Theoretical Calibration* parameter ().

2. Press the **Calibrate** softkey. The dead load value is captured and the cells trimmed based on the capacity and sensitivity values entered for the cells. Scale capacity is set at the total of the load cell capacities.

2-Point Calibration

2-point calibration is used for traditional scale calibration where load cells will not be trimmed. To perform a 2-point calibration:

1. Navigate to the *CALIB* menu, then select **2-POINT**.

2. Press **ENTER** or DOWN ($\triangledown$) to go to the *WZero* submenu.

3. Ensure there is no weight on the scale, then press the **Calibrate** softkey to calibrate WZero. Or, press one of the softkeys described below.

4. Press **ENTER** to accept the value and move to the next prompt (*WVAL*).

5. With *WVAL* displayed, press **ENTER** or DOWN ($\triangledown$) to view the stored test weight value. Use the numeric keypad to enter the desired value.

6. Press **ENTER** to advance to *WSPAN.*

7. With *WSPAN* displayed, press **ENTER** or DOWN $\triangledown$ to view the A/D count. Place test weights on the scale equal to WVAL. Press the **CALIBRATION** softkey to calibrate WSPAN.

8. Press **ENTER** to accept the value. Basic calibration is complete.

9. Press the **Save and Exit** softkey to return to weigh mode. To continue with linearization, see .

Cal-Match® Calibration (Corner, Section)

Cal-Match calibration can be performed using a vehicle as the test weight; however, a smaller footprint and heavier weight value often yields better results. Mechanical characteristics of the scale may prevent Cal-Match from automatically computing load cell trim factors.

To perform a Cal-Match calibration:

1. Navigate to the *CALIB* sub-menu. Select which calibration type to use: **CORNER** or **SECTION**.

2. Press **ENTER** or UP ($\triangledown$) to go to the *WVAL* menu.

3. Press **ENTER** or DOWN ($\triangledown$) to view the stored test weight value. Use the numeric keypad to enter the desired value. Press **ENTER** to accept the value and advance to Cal-Match.

4. Ensure all weight is removed from the scale and press the **Calibrate** softkey to begin the calibration. The Cal-Match calibration can be canceled by pressing the **CLEAR** key or the **CANCEL** softkey.

> **⚠ WARNING** *Cal-Match will overwrite any previous calibration. The Cal-Match can be discarded and revert to the previous calibration by cycling power to the iQUBE^2 before pressing Save and Exit.*

5. After initializing, Cal-Match *Point 1* is displayed. Place a test weight over first cell or section to be tested, then press **ENTER**.

> **📝 Note** *It is not necessary to measure the cells in any particular order.*

6. Once the iQUBE^2 has read the cell, Cal-Match *Point 2* is displayed on the 920i.

7. Move the test weight to the next cell or section and press **ENTER**. Repeat until all cells have been measured.

8. When the last cell has been measured, the iQUBE^2 automatically sets the load cell trim factors. Press **TWEAK** or **ENTER** to view trim values.

9. Press UP ($\triangle$) to return to the *SCALES* menu. Press the **Save and Exit** softkey to exit setup mode.
   See to continue with linearization.

4.3.2 Advanced Calibration Options

Temporary zero calibration and theoretical calibration are available regardless of the number of load cells connected or the calibration type selected. The calibration options described in this section are optional. Basic calibration can be performed by following the instructions in .

Selection	Description
Last Zero	Recalls the last established zero value to allow calibration without removing test weights or product from the scale. This must be followed by a span calibration.
Temp Zero	Temporarily zeros the displayed weight of a non-empty scale. After span calibration, the difference between the temp zero and the previously calibrated zero value is used as an offset. A previous calibration is required. This must be followed by a span calibration.

Table 4-7. Advanced Options

Linearization

Five-point linearization is used to compensate for non-linear scale systems by calibrating the indicator at up to five additional points between the zero and span calibrations. Linearization is optional; if linearization values have previously been entered, these values are reset to zero during the zero calibration.

1. Once basic calibration is complete, with *WLIN* displayed, press **ENTER** or DOWN ▽ to go to the first linearization point (*PT-> 1*).
2. Place test weights on the scale and press **ENTER** twice to display the weight value entry prompt.
3. Enter the actual test weight value using the numeric keypad. Press **ENTER** to accept the value.
4. Enter the *Calibrate* sub-menu. Use the **CALIBRATE** softkey to begin calibration of the linear point. When complete, the A/D count for the linear calibration is displayed. Press **ENTER** to acknowledge the value.
5. Use the LEFT △ and RIGHT ▷ keys to enter the next linearization point *PT-> 2*.
6. Repeat for up to five linearization points.
7. To exit the linearization parameters, press UP △ to return to *WLIN*.
8. Perform a rezero.

Performing a Re-zero

The re-zero function is used to remove a calibration offset when hooks or chains are used to hang the test weights. To perform a re-zero,

1. Remove the hooks or chains used during calibration, and remove any test weights from the scale.
2. With *REZERO* displayed, press **ENTER** or DOWN ▽ to access the re-zero function.
3. Ensure all weight is removed and press the **Calibrate** softkey to re-zero the scale.
4. Press **ENTER**, then press UP △ twice to return to the *CALIB* menu.

5.0   Virtui2 Configuration

This section describes configuration for the iQUBE^2 using the Virtui2 Configuration Utility. Instructions in this section assume that the configuration application is installed on the PC, and that load cell and communications wiring (between multiple iQUBE^2 boards, if applicable, and between the iQUBE^2 and the PC) is complete.
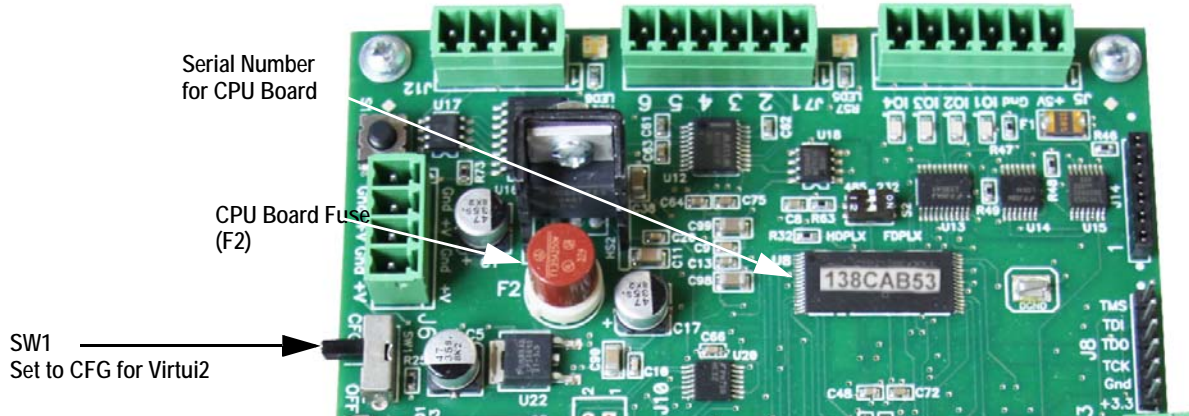
Figure 5-1. SW1 Location on CPU Board

Figure 5-2 shows the default section displayed when a configuration file is opened for editing. A graphic of the iQUBE^2, links to more information, and links to connector diagrams are displayed in this section.

Figure 5-2. Virtui2 iQUBE^2 Screen

Virtui2 Configuration

Virtui2 allows for configuration and calibration of the iQUBE^2 via PC interface.

Load cell assignment, digital inputs, setpoints, scale parameters, and printing can be customized.

Virtui2 offers web-based tools for weight display, diagnostics, and cell status. See the Virtui2 help files for more information.

> **Note** *Virtui2 uses two Windows services, **VirtuiService and Virtui Audit Trail Service**, that are installed with the Virtui2 application. By default, these services start automatically at system log on and control the PC serial port for iQUBE^2 communications when configured for RS-232.*

Starting/Stopping Virtui2 Services

When installed, Virtui2 adds two entries to Windows Services: *Virtui Audit Trail Service* and *Virtui Service* and their startup action is set to Automatic. These services must be temporarily stopped to allow other application use of the serial port.

To stop Virtui2 services:

1. Select *Services* from the Virtui2 Configuration Utility Tools menu.
   Or, from the Windows Start menu, select *Run...*, then type *services.msc* in the prompt and click OK.
   Or, from the Windows Start menu, select *Control Panel*, open Administrative Tools, then open Services.

2. With Services open, locate the two Virtui2 entries (*Virtui Audit Trail Service* and *VirtuiService*).

3. For each service, right-click and select Stop.

To start Virtui2 services, follow the above procedure, selecting Start instead of Stop in Step 3.

> **Note** *Services take several minutes to restart after a PC enters, then exits sleep mode. Check the computer's power settings to disable sleep mode, if necessary.*

5.1 Device Configuration

Device configuration allows for the customization of secondary device identification and sample rate.

1. Select *Device Configuration*. See Figure 5-2.

2. Select the Secondary Board Identification tab.

3. For each secondary device, enter the desired ID (located on the CPU board; see Figure 5-1 on page 45).

4. Set the address to a value other than 1 to activate the device. Each secondary device must have its own unique address between 2-254.

5. Use the General tab to specify the sample rate.

> **Note** *To deactivate a secondary device, set the address to 1.*
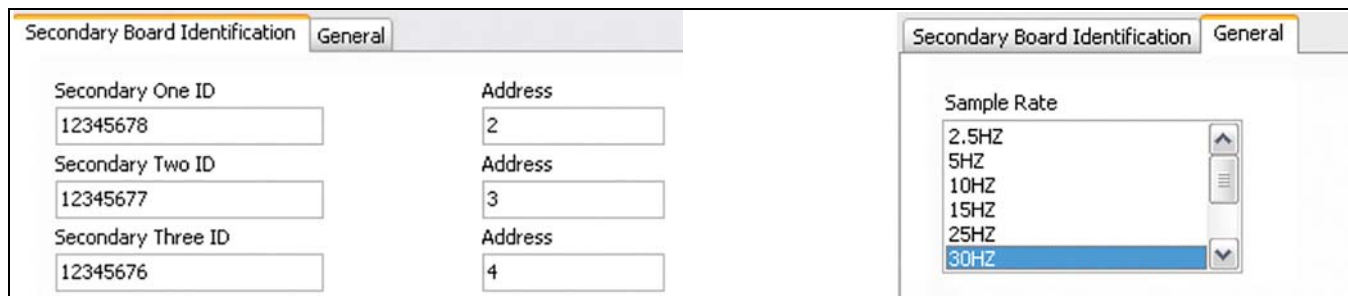
Figure 5-3. Device Configuration Screens

5.1.1 Communications

In this section communications settings and stream formats are set for the alternate communications port.

1. Select *Communications*.

2. Select the General tab.

3. Using the drop-down menus, specify the baud rate, terminator, end of line delay, prefix character, data bits/parity, echo, RS-485 address, postfix character, and stop bits as desired.

4. Select the Stream Format tab.

5. Use the buttons and to insert tokens into the stream output (streaming must be enabled in the *Scales* section). Organize the stream output into the desired order.

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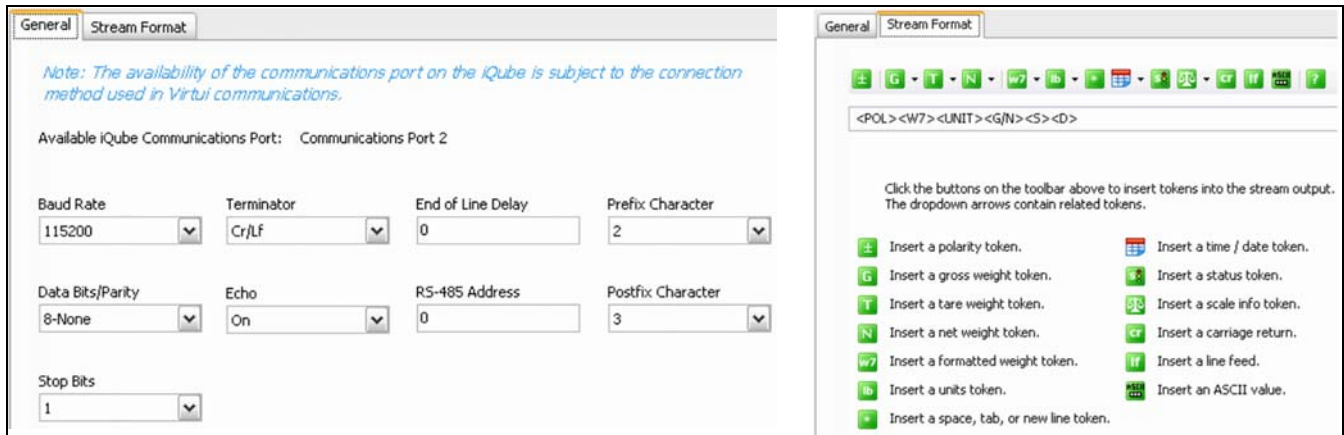
Figure 5-4. Communication Screens

5.1.2 Define Load Cells

The *Load Cells* section is used for the entry of capacity, sensitivity, name, serial number, zero value and normalization value for each load cell (up to 16).

1. Select *Load Cells*.

2. From the list of load cells, select the one to be customized.

3. Specify the capacity and sensitivity. Optionally, a load cell name and the load cell serial number can be entered.

4. Zero and normalization values are set when the scale is calibrated, but can be customized by entering new values in the text boxes.

5. Repeat Steps 1-4 for as many cells as are connected to the iQUBE[2].
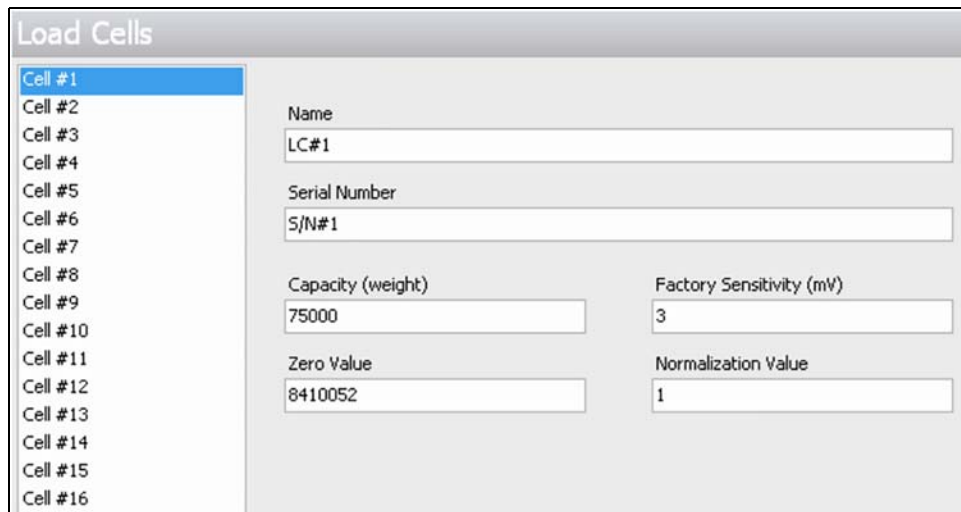
Figure 5-5. iQUBE[2] Section, Load Cells

5.1.3   Load Cell Assignment
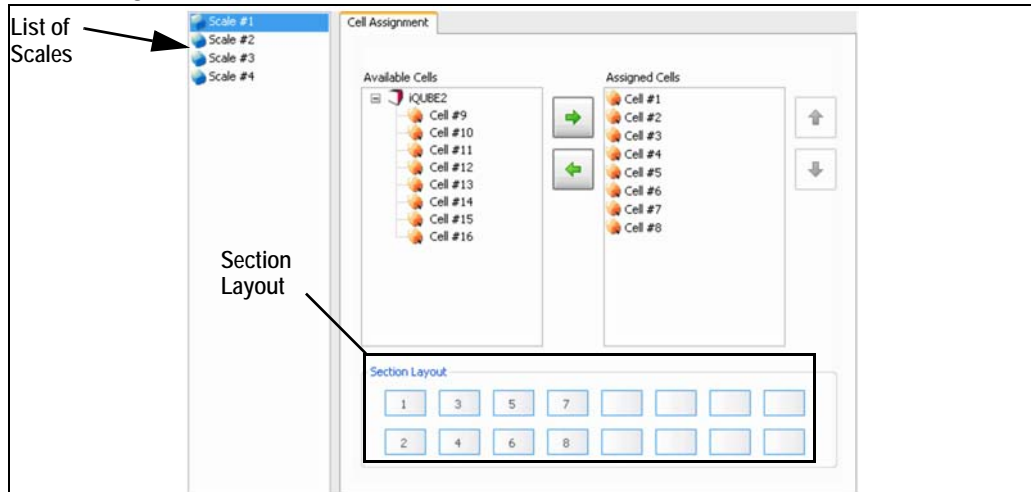
Figure 5-6. iQUBE² Section, Load Cell Assignment

Once the load cells have been defined, load cell assignment allows up to 16 load cells to be associated with up to four scales.

1. Select *Load Cell Assignment*.
2. From the listing of scales, select the scale being configured (Scale #1 – Scale #4).
3. Select load cells from the *Available Cells* list and press ➡ to move numbered load cells to the *Assigned Cells* list

    for that scale. (Use ⬅ to return a selected cell to the *Available Cells* list.)

A representation of load cell locations in the scale is shown in the *Section Layout* portion of the display.

For all scales, use ⬆ and ⬇ to arrange the cells shown in the *Section Layout* view to reflect the physical layout of the load cells. *Section Layout* provides essential information to the system about cell relationships. Calibration and diagnostic functions depend on an accurate representation of the scale.

> **Note** *Load cells do not have to be on the same board to be paired with each other.*

5.1.4   Scale Configuration
Scale configuration can be accomplished via the *System* section in the left pane. Click *System* to expand this section.

1. From the left pane, with the *System* section expanded, click *Scales*.
2. From the listing of scales, click on the one to be configured.
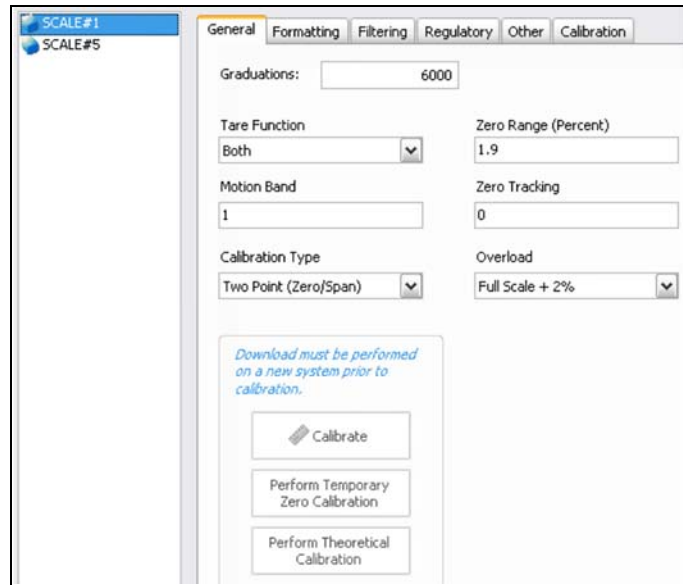
Figure 5-7. System Section, Scale — General Tab

3. Use the *General*, *Formatting*, *Filtering*, *Regulatory*, *Other*, and *Calibration* tabs to set up the scale. Refer to Virtui2's help system for detailed instructions.

5.1.5 Additional iQUBE² System Configuration

Additional configuration options are available under the *System* tab for setpoints, digital inputs, and diagnostics. Refer to Virtui2's help system for detailed information on these options.

See Section 6.0 on page 56 for more information about iQUBE² diagnostic functions.

5.1.6 Print Formatting

Print formatting parameters can be edited by clicking *Formatting* under the *Printing* section in the left pane. The *Printing* tab, when expanded, shows the Formatting selection. This allows for consecutive numbering and custom print tickets (gross and net).

Figure 5-8. Gross Format

Numbering Tab

This tab allows options for specifying consecutive numbering options (start, next, and ID). The consecutive number value is incremented following each print operation that includes <CN> in the ticket format.
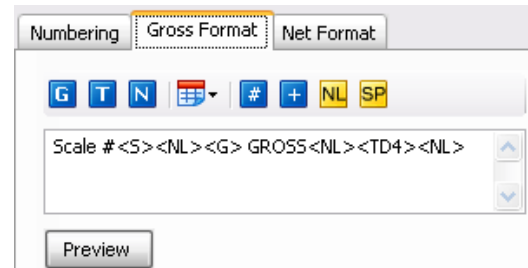
Gross Format and Net Format tabs

Use these tabs to specify the gross and net print formats.

Click the **Preview** button to view a sample print ticket based on the tokens displayed in the text area.

Button	Description
G	Gross weight field - inserts gross weight value into the ticket format.
T	Tare weight field - inserts tare value into the ticket format.
N	Net weight field - inserts the net weight into the ticket format.
(date icon)	Date - select the desired date information and format from the pull-down list appearing after this button is clicked.

Table 5-1. Print Formatting Token Buttons

Button	Description
#	Scale ID - inserts the scale ID number.
+	Consecutive Number - inserts a consecutive number field into the ticket format
NL	New Line - inserts a new line in the ticket
SP	Space - inserts a space in the selected line of the ticket.

Table 5-1. Print Formatting Token Buttons (Continued)

5.1.7   Sending Configuration to iQUBE[2]

Once configuration is complete, it must be sent to iQUBE[2].

1. Set SW1 to CFG, if not currently connected to the iQUBE[2]. See Figure 5-1 on page 45.

2. From the *Communications* menu, select **Connect**. An icon in Virtui2's status bar (located at the bottom of the window) indicates a connection.

Figure 5-9. Connection Icon

3. Once connected, click **Send Configuration** from the tool bar, or select **Send Configuration to** iQUBE[2] from the *Communications* menu.

5.2   Configuration Utility Calibration

Calibration types depend on how many load cells are connected to iQUBE[2]. See Table 5-2. If only one load cell is connected, only 2-point calibration will be available.

The iQUBE[2] can be calibrated by using the Virtui2 Configuration Utility, host device or serial commands. No minimum test weight values are required; however, at least 10% of the scale capacity is recommended.

Calibration Type	Description
2-Point	Traditional span calibration. No trimming will be done.
Corner	Used when weight will be placed over each load cell.
Section	Used when load cells are paired with each other and calibrated in those pairs.
Theoretical	Mathematically calibrates the scale using full scale capacity and load cell sensitivities.

Table 5-2. Calibration Types

To access calibration, within the program click **System** from the left pane to expand the *System* section. Then, with the *System* section expanded, from the left pane click the **Scales** button.
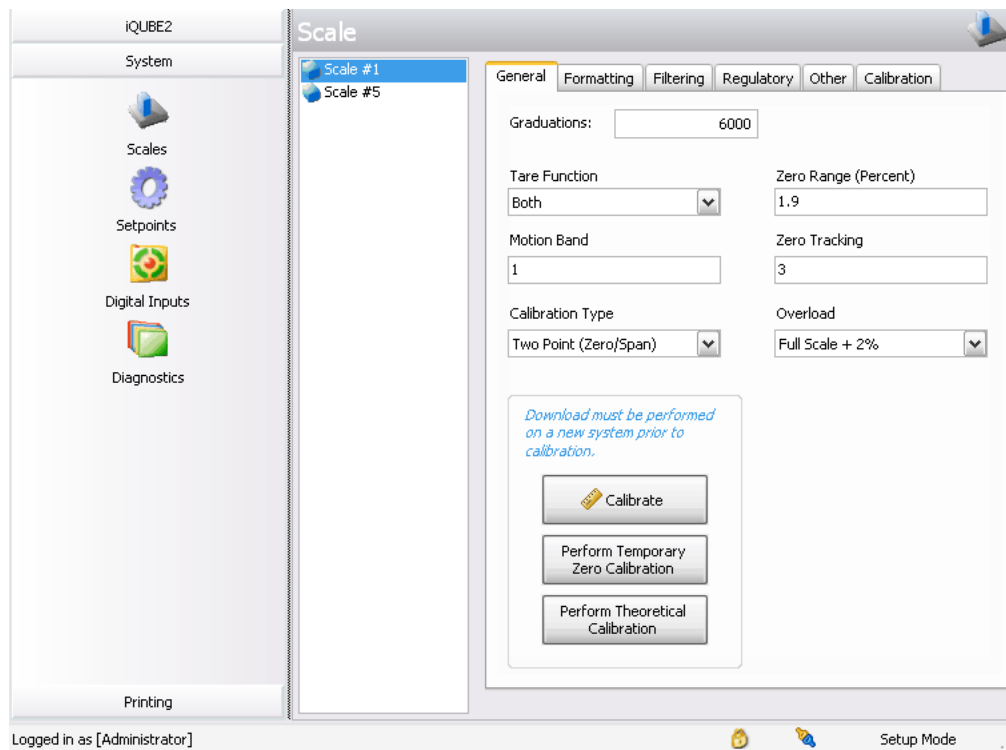
Figure 5-10. Virtui2 Scales Calibration, General Tab

The scale must be configured and the configuration sent to iQUBE² before calibrating. See   Section 5.1   for configuration instructions. Log into the Virtui2 Configuration Utility as an administrator to access the calibration menu. The default login is Administrator with a blank password.

> **Note** *Calibration is an immediate process. The scale will be calibrated upon completion of the Calibration Wizard.*
> *If linearization points are used, they will be sorted in ascending order upon completion of the Calibration Wizard.*

5.2.1   2-Point Calibration

This option calibrates a single load cell or scale with one load cell per A/D.

1. From the *Scales* section, select the scale to be calibrated.

2. From the **General** tab, select **Two Point (Zero/Span)** from the *Calibration Type* pull-down menu.

3. Click the **Calibrate** button. The Two-Point Calibration wizard appears.
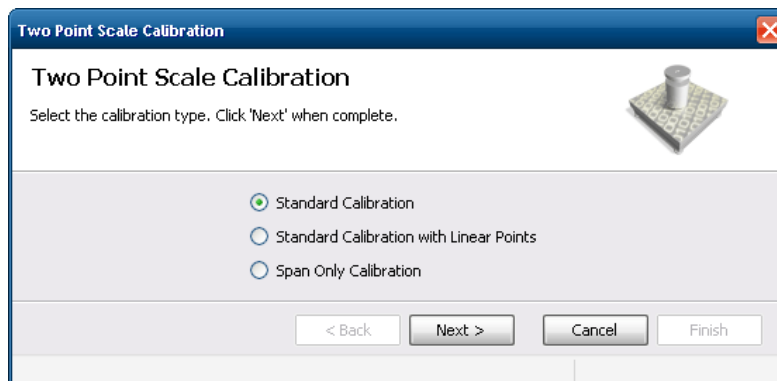
Figure 5-11. Two-Point Calibration wizard

4. Select the calibration type. Press **Next**.

5. Enter the amount of test weight being used.

6. If applicable, select *Chains or Hooks are used during calibration* and press Next.

7. Remove all weight from the scale and press Calibrate Zero. To use the zero acquired from the last press of the Zero button, select *Use Last Zero*.

Note	*The status bar (lower left corner) of the window displays Transmitting... until calibration is finished. It then displays Zero Calibration Complete.*

8. Press Next.

9. Add the test weight to the scale and press Calibrate Span.

10. If linear points were selected in Step 4, enter the applied weight in the text box and press Measure. *Success* displays.

Figure 5-12. Two-Point Calibration Wizard

11. Press Next.

12. If chains or hooks are being used, remove them (along with all other weight) from the scale and select *Re-Zero Calibrate*.

13. Press Next. Calibration is complete.

14. Press Finish to commit the calibration values and send them to iQUBE[2].

Press Cancel *to abort; this will require a re-calibration at a later time.*

5.2.2   Corner Match

This option is used for calibration and to trim cells based on weight placed on individual load cells.

1. From the *Scales* section, select the scale to be calibrated.

2. From the *General* tab, select *Corner Match* from the *Calibration Type* pull-down menu.

3. Press Calibrate. The *Corner Match Calibration* wizard displays.

4. Select a standard calibration with or without linear points. Press Next.

5. Enter the amount of test weight being used.

6. If certified test weights are being used during cell normalization, select the check box. This calibrates the scale during normalization.

7. If chains or hooks are being used during the calibration, select the check box.

8. Remove all weight from the platform and press Calibrate Zero. To use the zero acquired from the last press of Zero, select *Use Last Zero*.

   The status bar (lower left corner) of the window displays Transmitting... until the calibration is finished. It then displays Zero Calibration Complete.

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9. Press Next. The *Corner Match Calibration Wizard* displays all load cells installed on the system.
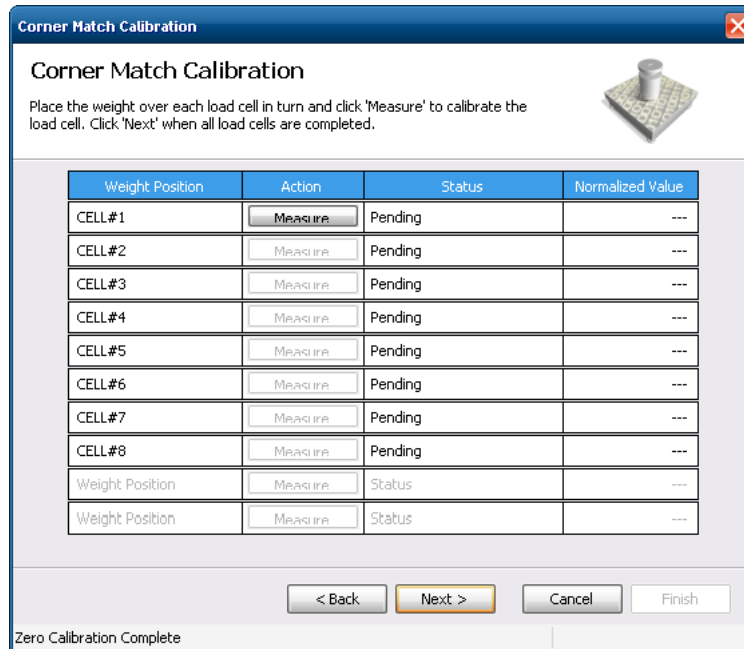
Figure 5-13. Corner Match Calibration Wizard

10. Place a test weight of the value entered in step 5, over the specific load cell.

11. Press **Measure** for the load cell corresponding to the corner with weight on it. Under Status, *Success* displays when the measurement is finished. As each measurement is completed, the next cell becomes available to measure.

12. Repeat steps 10-11 until each cell has been measured.

13. Press Next.

14. If certified test weights are not used, a span calibration must be completed. If they were used (Step 6), the calibration was completed during normalization.

15. Add the test weight to the scale and press Calibrate Span.

16. If linear points were selected in Step 4, enter the applied weight in the text box and press Measure. *Success* displays when complete.

17. Press Next.

18. If chains or hooks are being used, remove them (along with all other weight) from the scale and select *Re-Zero Calibrate*.

19. Press Next. Calibration is complete.

20. Press Finish to accept the calibration values and send them to iQUBE[2].

*Press **Cancel** to abort; this will require a re-calibration at a later time.*

5.2.3 Section Match
This option measures and trims load cell values in platform section pairs, and allows cell trimming.

1. From the *Scales* section, select the scale to be calibrated.

2. From the **General** tab, select *Section Match* from the *Calibration Type* pull-down menu.

3. Press Calibrate. The *Section Calibration* wizard displays.

4. Select whether to perform a standard calibration with or without linear points, then press Next.

5. Enter the amount of test weight being used.

6. If certified test weights are being used during cell normalization, select the check box. This will calibrate the scale during normalization. If chains or hooks are being used during the calibration, select the check box.

7. Remove all weight from the platform and press Calibrate Zero. To use the zero acquired from the last press Zero, press Use Last Zero.

Note *The status bar (lower left corner) of the window displays "Transmitting..." until calibration is finished. It then displays "Zero Calibration Complete."*

8. Press Next. The *Section Match Calibration Wizard* displays all load cells installed on the system.
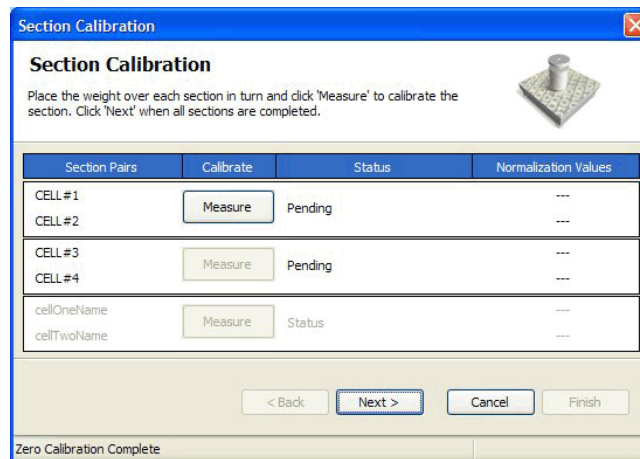
Figure 5-14. Section Calibration Wizard

9. Place a test weight of the value entered in step 5, on a section of the scale.

10. Press Measure for the load cell pair corresponding to the section with weight on it. *Success* displays when the measurement is finished. As each measurement is completed, the next cell becomes available to measure.

11. Repeat steps 9-10 until each section has been measured.

12. Press Next.

13. If certified test weights are not used, a span calibration must be completed. If they were used (Step 7), the calibration was completed during normalization.

14. Add the test weight to the scale and press Calibrate Span.

15. If linear points were selected in Step 4, enter the applied weight in the text box and press Measure. *Success* displays when complete.

16. Press Next.

17. If chains or hooks are used, remove them (along with all other weight) from the scale and select *Re-Zero Calibrate*. Press Next.

18. Calibration is complete. Press Finish to accept the calibration values and send them to iQUBE^2.

Press Cancel to abort; this will require a re-calibration at a later time.

5.2.4   Theoretical Calibration
This option mathematically calibrates the scale using the full scale capacity and load cell sensitivities. Load cell sensitivities can be specified using the procedure explained in .

1. Press Perform Theoretical Calibration.

2. Press Calibrate.

3. If all load cell specific data (capacity and sensitivity) has been entered for the scale, press Yes.

4. Ensure there is no weight on the scale and press OK. Theoretical calibration is complete.

5.2.5   Temporary Zero Calibration
This option uses the zero value from the last calibration and performs only a span calibration. This calibration option could be used, for example, for a tank that isn't empty.

1. From the *General* tab, select *Temporary Zero Calibration* from the *Calibration Type* pull-down menu.

2. Press *Calibrate*. The *Temporary Zero Calibration* wizard appears.

3. If linear points are used, enter the applied weight in the text box and press Measure. *Success* displays when complete.

4. Press Next.

5. If chains or hooks are used, remove them along with all other weight, from the scale and press Re-Zero Calibrate.

6. Press Next. Calibration is complete.

7. Press **Finish** to accept the calibration values and send them to the iQUBE^2.

*Press **Cancel** to abort; this will require a re-calibration at a later time.*

6.0   Serial Commands

The iQUBE[2] can be controlled by a PC using a terminal emulation program (such as HyperTerminal). Control is provided by a set of serial commands that display and change setup parameters and perform reporting functions. The serial commands provide the capability to print configuration data or to save that data to an attached personal computer. This section describes the serial command set and procedures for saving and transferring data using the serial ports. The following section lists the serial commands used to configure and control the iQUBE[2].

Command	Description	Values
DUMPALL	List all parameter values	—
DUMP.COM	List communications port parameters	—
DUMP.FMT	List poll and stream format parameters	—
DUMP.LC	List load cell parameters	—
DUMP.SC	List scale parameters for all scales	—
DUMP.SCs	List scale parameters for scale s	1–5 (5 = total scale)
DUMP.SP	List setpoint parameters for all setpoints	—
DUMP.SPn	List setpoint parameters for setpoint	1–4

Table 6-1. iQUBE[2] Reporting Commands

Command	Description
VERSION	Write iQUBE[2] software version
SERIAL_NUMBER	Write serial number (board ID) of primary board
MS.AUTO	Places system in MS.AUTO mode to acquire Secondary Board IDs and automatically assign & download Addresses*
MS*n*.ID	Reads/configures the ID of Secondary Board *n (1-3)* in the Master only
MS*n*.ADDR	Reads/configures the address of Secondary Board *n (1-3)* in the Master only
MSLIST	Returns all addresses registered with the master
MS.RESCAN	Registers configured secondary boards with master; automatic when initializing calibration or entering weigh mode
MSn yyyyyyyy zz	Configures Secondary Board *n (1-3)* as ID (yyyyyyyy) and address *(zz);* downloads address to secondary board* (write-only)
SMPRAT	Set sample rate; 2.5HZ, 5HZ, 10HZ, 15HZ, 25HZ, 30HZ, 50HZ, 60HZ, 100HZ, 500HZ
SD	Set date (not battery-backed); enter using specified date format (DATEFMT)
ST	Set time (not battery-backed); enter using specified time format (TIMEFMT)
DATEFMT	Date format; MMDDYY, DDMMYY, YYMMDD, YYDDMM
DATESEP	Date separator; SLASH, DASH, SEMI
TIMEFMT	Time format; 12HOUR, 24HOUR
TIMESEP	Time separator; COLON, COMMA
RS	Reset primary board (equivalent to cycling power)
RESETCONFIGURA-TION	Reset system, restore to factory defaults
RESETDEFAULTS	Reset system defaults but retain M/S communications configuration (IDs and addresses)
SYSMODE	Show current SW1 setup switch position; if SW1 in CFG = *SETUP*; if SW1 in OFF = *WEIGH*
VOLTSEXC	Show primary board excitation voltage
VOLTSPS	Show primary board power supply voltage

Table 6-2. iQUBE[2] System Commands

Command	Description
WHOAMI	Returns information about iQUBE^2 including master ID, version, port configuration.
* These commands also store the configuration to EEPROM.	

Table 6-2. iQUBE^2 System Commands (Continued)

Command s = scale number	Description
SX	Start streaming for all scales
EX	End streaming for all scales
SCs.SX	Start streaming for scale s
SCs.EX	End streaming scale s
P	Write one frame of polling format from all scales
S	Write one frame of streamed format from all scales
SCs.COUNTS	Read A/D counts
SCs.CMV	Read corrected mV value
SCs.SIM	Emulate cell; NONE, 1–16
SCs.WEIGHT	Read weight value
SCs.ZERO	Perform zero operation for scale s
SCs.P	Write one frame of polling format from scale s
SCs.S	Write one frame of streamed format from scale s
SCs.TARE	Perform pushbutton tare operation for scale s
SCs.SETTARE	Perform keyed tare operation for scale s
SCs.PRINT	Perform print operation for scale s
SCs.CLRTARE	Perform clear tare operation scale s
SCs.GROSSNET	Toggle gross/net mode for scale s
SCs.GROSS	Set scale s to gross mode
SCs.NET	Set scale s to net mode
SCs.PRI	Set scale s to primary units
SCs.SEC	Set scale s to secondary units
SCs.UNITS	Toggle primary/secondary units for scale s
SCs.ZERO	Perform zero operation for scale s

Table 6-3. iQUBE^2 Weigh Mode Commands

See for more information about data formatting commands.

Command s = scale number	Description
SCs.STREAM	Enable streaming for iQUBE^2 port; OFF, COM1, COM2, COM1&2
SCs.GFMT	Set gross format for scale s; FMT1–FMT6
SCs.NFMT	Set net format for scale s; FMT1–FMT6
SCs.SFMT	Set stream format for scale s; FMT1–FMT6
SCs.PFMT	Set polling format for scale s; FMT1–FMT6
FMT n	Set format n; specify up to 128 characters

Table 6-4. iQUBE^2 Data Formatting Commands

Command s = scale number	Description
SC*s*.GRADS	Graduations; *1–100 000*
SC*s*.CAPACITY	Returns calculated scale capacity
SC*s*.ZTRKBND	Zero track band
SC*s*.ZRANGE	Zero range
SC*s*.MOTBAND	Motion band
SC*s*.OVRLOAD	Overload; FS+2%, FS+1D, FS+9D, FS
SC*s*.DFSENS	Digital filter cutout sensitivity; LIGHT, MEDIUM, HEAVY
SC*s*.DFTHRH	Digital filter threshold count; NONE, 10, 20, 30, 50, 100, 150, 200, 250, 500, 1000, 2500, 5000, 7500, 10000, 12500, 15000
SC*s*.UID	Set UID of primary unit; *nnnnnn*
SC*s*.CONSNUM	Consecutive numbering; *0–9999999*
SC*s*.CONSTUP	Consecutive number start-up value; *nnnnnn*
SC*s*.PRI.DECPNT	Primary units decimal position; 8.88888, 88.8888, 888.888, 8888.88, 88888.8, 888888, 888880, 888800
SC*s*.PRI.DSPDIV	Primary units display divisions; 1D, 2D, 5D
SC*s*.PRI.UNITS	Primary units; LB, KG, OZ, TN, T, G, NONE
SC*s*.SEC.DECPNT	Secondary units decimal position; 8.88888, 88.8888, 888.888, 8888.88, 88888.8, 888888, 888880, 888800
SC*s*.SEC.DSPDIV	Secondary units display divisions; 1D, 2D, 5D
SC*s*.SEC.UNITS	Secondary units; LB, KG, OZ, TN, T, G, NONE
SC*s*.SEC.MULT	Secondary units multiplier; *0.00001–9999.99*
SC*s*.TAREFN	Tare function; BOTH, NOTARE, PBTARE, KEYED
SC*s*.REGULAT	Regulatory compliance; NTEP, OIML, CANADA, NONE
SC*s*.NAME	Scale name; Scale1,scale_name (24 characters, maximum)
SC*s*.NCELLS	Assign load cells; 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0 (specify comma-separated list of load cell numbers associated with this platform) or NONE (to clear load cell list) *NOTE: Order entry determines cell pairing relationships.*
SC5.SCALES	Sets up the total scale (Scale 5)
SC*s*.CALMULT	Calibration multiplier; 1.0, number

Table 6-5. iQUBE[2] Scale Configuration Commands

Command c = load cell number	Description	Values
LC*c*.ID	Load cell ID	Load Cell A1, *load_cell_ID (16 characters, maximum)*
LC*c*.SRLNUM	Load cell serial number	**(16 characters, maximum)**
LC*c*.CAPACITY	Load cell capacity	0-1,000,000
LC*c*.SENS	Load cell sensitivity	0.0001–9.9999 (mV/V)
LC*c*.TRIM	Load cell trim factor	0–5.0000
LC*c*.ZERO	Load cell zero counts value	0–16777215
LC*c*.COUNTS	Read A/D count	—
LC*c*.CDMV	Read corrected dead load mV value	—
LC*c*.RMV	Read raw mV value	—
LC*c*.CMV	Read corrected mV value	—

Table 6-6. iQUBE[2] Load Cell Commands

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Command c = load cell number	Description	Values
LCc.WEIGHT	Read calibrated weight value	—
LCx.SAMPLEn	Uploads/Downloads calibration values for the given (n) Cal-Match calibration step (	-16777215–*16777215*
LCx.SAMPLE	Uploads/Downloads calibration values for all calibration steps	-16777215–*16777215*

Table 6-6. iQUBE[2] Load Cell Commands (Continued)

Command s = scale number	Description	Values
SCs.CALTYPE	Calibration type	SECMATCH, CORNERMATCH, 2-POINT
Calibration commands for CALTYPE = SECMATCH, CORNERMATCH		
SCs.CAL0	Zero calibration	—
SCs.CALn	Calibration step n	Assign calibration step number (1–16, maximum) for each load cell in CORNERMATCH calibration, for each section pair (1–8, maximum) in SECTION-MATCH calibration
SCs.NORM	Normalize platform	Final calibration step after completing SCs.CAL0 through SCs.CALn
Calibration commands for CALTYPE = SINGLE, MULTI		
SCs.WZERO	Zero calibration	—
SCs.WVAL	Platform test weight value	0–*9999999*
SCs.WSPAN	Platform span calibration	0–16777215
Other calibration commands		
SCs.LC.CD	Set dead load coefficient	0–16777215
SCs.LC.CW	Set span coefficient	0–16777215
SCs.LC.CZ	Set temporary zero	0–16777215
SCs.REZERO	Re-zero	0–16777215
SCs.LASTZERO	Last zero	0–16777215
SCs.WLIN.W1–SCs.WLIN.W5	Raw count value for linearization points 1–*5*	0–16777215
SCs.WLIN.V1–SCs.WLIN.V5	Test weight value for linearization points 1–*5*	-999999–*9999999*
SCs.WLIN.C1–SCs.WLIN.C5	Calibrate linearization points 1–*5*	—
SCs.CALSPAN	Platform span calibration on *Cal-Match* scale types	

Table 6-7. iQUBE[2] Calibration Commands

Command p = port number	Description	Values
COMMOPTS	Lists any option cards installed	DEFAULT=7, Fiber=6, Ethernet=5, WiPort=4, Reserved=3, USB=2, RS232/485=1
COMp.ADDRESS	Port RS-485 address	0=OFF, *1–254*

Table 6-8. iQUBE[2] Serial Port Commands

Command *p* = port number	Description	Values
COM*p*.BAUD	Port baud rate	9600, 19200, 38400, 57600, 115200, 230400, 450000, 460800
COM*p*.BITS	Port data bits and parity	1, 2
COM*p*.SBITS	Port stop bits	1, 2
COM*p*.TERMIN	Port termination character	CR/LF, CR, NONE
COM*p*.EOLDLY	Port end-of-line delay	*0–25* (0.1-second intervals)
COM*p*.ECHO	Port character echo	ON, OFF
COM*p*.CHECK	Port cyclical redundancy check (CRC)	OFF, CRC
COM*p*.STRM.CHECK	Append data integrity check to streamed data	OFF, CKSUM, ACKSUM, CRC, ACRC See NOTE below
COM*p*.STRM.POST	Post-fix character to streaming frame format	0 (none), *last_character* (ASCII decimal value)
COM*p*.STRM.PREF	Prefix character to streaming frame format	0 (none), *first_character* (ASCII decimal value)
COM*p*.P.CHECK	Append data integrity check to polled data	OFF, CKSUM, ACKSUM, CRC, ACRC See NOTE below
COM*p*.P.POST	Post-fix character to polling frame format	0 (none), *last_character* (ASCII decimal value)
COM*p*.P.PREF	Pre-fix character to polling frame format	0 (none), *first_character* (ASCII decimal value)
Values for the COMp.STRM.CHECK and COMp.P.CHECK command are as follows: • OFF – No check data appended • CKSUM – Sum of characters appended in binary (2 bytes) • ACKSUM – Sum of characters appended in hexadecimal ASCII (4 bytes) • CRC – CRC data appended in binary (2 bytes) • ACRC – CRC data appended in hexadecimal ASCII (4 bytes)		

Table 6-8. iQUBE[2] Serial Port Commands (Continued)

Command *n* = setpoint number	Description	Values
SP*n*.ENABLE	Setpoint enable	OFF, ON
SP*n*.KIND	Setpoint kind	GROSS, NET
SP*n*.VALUE	Setpoint value	–999999 – 999999
SP*n*.TRIP	Setpoint trip	HIGHER, LOWER, INBAND, OUTBAND
SP*n*.BNDVAL	Setpoint band value	0–999999
SP*n*.HYSTER	Setpoint hysteresis	0–999999
SP*n*.DIGOUT	Setpoint digital output	1, 2, 3, 4

Table 6-9. iQUBE[2] Setpoint Commands

Command *n* = digital I/O bit number	Description	Values
DIGIO*n*	Set digital I/O bit function	OFF, ZERO, TARE, NT/GRS, UNITS, PRINT, CLRCN, CLRTAR, SETPNT, CELHLTH, HOSTCTL
DIGIO*n*.SCALE	Assign digital I/O bit *n* to scale	1–5 (scale number)
DIN#0	Read all digital inputs	Returns value 0–*F (status of bits 1–4 represented as hexadecimal values 1, 2, 4, 8)*

Table 6-10. iQUBE[2] Digital I/O Commands

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Command *n* = digital I/O bit number	Description	Values
DIN#*n*	Read digital input *n*	1=low, 0=high
DON#0	Set all digital outputs on (active)	—
DON#*n*	Set digital output *n* on	1–4
DOFF#0	Set all digital outputs off (inactive)	—
DOFF#*n*	Set digital output *n* off	1–4
MSDOUT	Reads all outputs in the system	—

Table 6-10. iQUBE² Digital I/O Commands (Continued)

See for more information about the commands listed in Table 6-11.

Command *s* = scale number	Description	Values
DIA.PS	Query power supply error	—
DIA.MSCONNECT	Query secondary connection error	—
DIA.PSEXC	Query excitation error	—
DIA.CELLCONNECT	Query cell connection error	—
DIA.FLAGS	Show all diagnostic flags simultaneously	—
DIA.CLEAR	Clear all diagnostic flags	—
DIA.OVERLOAD	Query cell overload error	—
SC*s*.DIA.OVERLOAD	Set cell overload value	*-100.00 – 150.00* (percent)
DIA.UNDERLOAD	Query cell under-load error	—
SC*s*.DIA.UNDERLOAD	Set cell under-load value	*-100.00 – 100.00* (percent)
DIA.ZREF	Query zero reference error	
SC*s*.DIA.ZREF	Enable zero reference diagnostic	OFF, ON
SC*s*.DIA.ZREF.RANGE	Set zero reference range	*-100.00 – 100.00* (percent)
SC*s*.DIA.ZREF.THRESH	Set zero reference threshold	*-100.00 – 100.00* (percent)
SC*s*.DIA.ZREF.TIME	Set zero reference timer	*1 – 60* (seconds)
DIA.DRIFT	Query cell drift error	—
SC*s*.DIA.DRIFT	Enable cell drift diagnostic	OFF, ON
SC*s*.DIA.DRIFT.RANGE	Set cell drift range	*-100.00 – 100.00* (percent)
SC*s*.DIA.DRIFT.THRESH	Set cell drift threshold	*-100.00 – 100.00* (percent)
SC*s*.DIA.DRIFT.TIME	Set cell drift timer	*1 – 300* (seconds)
DIA.SDALL	Returns real-time load cell noise (in counts)	
DIA.NOISE	Enable peak-to-peak noise diagnostic	OFF, ON
DIA.NOISE.THRESH	Set peak-to-peak noise threshold for all scales	*0.01 – 1000* (microvolts)
DIA.NOISE.TIME	Set peak-to-peak noise timer	*1 – 300* (seconds)
DIA.UNBAL	Query unbalanced load error	—
SC*s*.DIA.UNBAL	Enable unbalanced load diagnostic	OFF, ON
SC*s*.DIA.UNBAL.RANGE	Set unbalanced load range	*-100.00 – 100.00* (percent)
SC*s*.DIA.UNBAL.THRESH	Set unbalanced load threshold	*-100.00 – 100.00* (percent)

Table 6-11. iQUBE² Diagnostic Commands

7.0   Diagnostics

The advanced diagnostic capabilities of the iQUBE[2] include power supply and excitation voltage monitoring, load cell connection faults, cell overload or under-load, unbalanced load, load cell drift, load cell peak-to-peak noise and zero reference. Diagnostic flexibility allows for simple configuration and the ability to include the diagnostics in the weight data or to monitor diagnostics on a separate communication port from weight data.

Load Cell Status

The iQUBE[2] CPU board provides bi-color cell status LEDs next to each load cell connector. These LEDs indicate the status of connected load cells.

LED Color	Meaning
Green	Load cell good
Red	Load cell error
Red/green flashing	Consistent error being cleared by host
Off	Disabled/load cell not assigned to a scale

Table 7-1. LED Status Indications

7.1   Diagnostic Functions

The iQUBE[2] provides three types of diagnostic functions: system, cell, and scale diagnostics.

- System diagnostics monitor the power supply and excitation voltages and communications between primary and secondary boards. System diagnostics are always enabled.
- Cell diagnostics monitor cell connection, cell overload, and cell under-load conditions. Cell diagnostics are enabled for all cells that are assigned to a scale.
- Scale diagnostics provide control parameters to allow configuration for specific scale applications and must be explicitly enabled. Scale diagnostic commands provide monitoring for zero reference, cell drift, peak-to-peak noise, and unbalanced load conditions.

7.1.1   Diagnostic Error Detection

Diagnostics generate a code that can be included in any of the six available data formats, FMT1 through FMT6 (see Section 7.0 on page 62). By default, the diagnostic code token, <D>, is included in FMT3 and FMT6. While a failure in a scale system may generate several error conditions, only the most critical diagnostic code is shown at one time. Table 7-2 shows the diagnostic codes for the various error types, in priority order.

Diagnostic Code <D>	Error Type	Associated Query Command
P	Power supply	DIA.PS
S	Secondary communication	DIA.MSCONNECT
E	Excitation	DIA.PSEXC
C	Cell connection	DIA.CELLCONNECT
R	Zero reference	DIA.ZREF
V	Overloaded cell	DIA.OVERLOAD
D	Drift	DIA.DRIFT
U	Underloaded cell	DIA.UNDERLOAD
N	Peak noise	DIA.NOISE
L	Unbalanced cell	DIA.UNBAL
<space>	No error	—

Table 7-2. Diagnostic Codes and Query Commands

7.1.2 Retrieving Diagnostic Data

Table 7-2 also lists the diagnostic query commands associated with each of the diagnostic codes. When a diagnostic code is generated, the related query command can be used to retrieve additional information about the error.

> **Note** *Using the query command for a given error also clears the diagnostic flag for that error. Once cleared, that data is no longer available.*

7.2 Diagnostic Commands

Table 7-3 summarizes the diagnostic commands available for the iQUBE[2], including query commands, parameter-setting commands, and the values that can be assigned by the parameter-setting commands. The diagnostic commands are described in detail in the following sections.

<D>	Error Type	Query Command	Parameter Setting Commands	Parameter Values	
				Default	Value Range
P	Power supply	DIA.PS	—	—	—
S	Secondary communication	DIA.MSCONNECT	—	—	—
E	Excitation	DIA.PSEXC	—	—	—
C	Cell connection	DIA.CELLCONNECT	—	—	—
V	Overloaded cell	DIA.OVERLOAD	SC*s*.DIA.OVERLOAD	100	*−100 − 150* (percent of cell)
U	Underloaded cell	DIA.UNDERLOAD	SC*s*.DIA.UNDERLOAD	10	*-100.00 − 100.00* (percent)
R	Zero reference	DIA.ZREF	SC*s*.DIA.ZREF	OFF	OFF, ON
			SC*s*.DIA.ZREF.RANGE	2	*-100.00 − 100.00* (percent)
			SC*s*.DIA.ZREF.THRESH	10	*-100.00 − 100.00* (percent)
			SC*s*.DIA.ZREF.TIME	10	*1 − 60* (seconds)
D	Drift	DIA.DRIFT	SC*s*.DIA.DRIFT	OFF	OFF, ON
			SC*s*.DIA.DRIFT.RANGE	2	*-100.00 − 100.00* (percent)
			SC*s*.DIA.DRIFT.THRESH	2	*-100.00 − 100.00* (percent)
			SC*s*.DIA.DRIFT.TIME	10	*1 − 300* (seconds)
N	Peak noise	DIA.NOISE	SC*s*.DIA.NOISE	OFF	OFF, ON
			DIA.NOISE.THRESH	10.00	*0.01 − 1000* (μV)
			SC*s*.DIA.NOISE.TIME	10	*1 − 300* (seconds)
L	Unbalanced cell	DIA.UNBAL	SC*s*.DIA.UNBAL	OFF	OFF, ON
			SC*s*.DIA.UNBAL.RANGE	5	*-100.00 − 100.00* (percent)
			SC*s*.DIA.UNBAL.THRESH	10	*-100.00 − 100.00* (percent)
—	All	DIA.FLAGS	—	—	—
—	All	DIA.CLEAR	—	—	—

Table 7-3. Diagnostic Command Summary

7.2.1 System Diagnostic Commands

System diagnostic commands consist of query commands only; there are no parameter-setting commands. System diagnostics are always enabled.

> **Note** *For data formats that include the <S> status token, some system diagnostic errors also set the status to* **I** *(invalid).*

Power Supply Error, <D> = P

The power supply diagnostic flag is set when any CPU board in the system has a power supply fault (input voltage less than 6 VDC or greater than 12 VDC).

Use the DIA.PS query command to retrieve diagnostic information for P-type error conditions.

Query Command Example:

```
DIA.PS
DIA.PS=SC2; SC3;
```

The iQUBE² responds to the DIA.PS query command with SC2; SC3, indicating that the board affected by the power supply error is common to both Scale 2 (SC2) and Scale 3.

Secondary Communication Error, <D> = S

The secondary communication diagnostic flag is set when any configured secondary CPU board loses communication with the primary CPU board.

Query Command Example:

    DIA.MSCONNECT
    DIA.MSCONNECT=S1 121A295A;

The query response indicates that the first secondary unit (**S1**), with board ID 121A295A, has lost connection to the primary unit.

Excitation Voltage Error, <D> = E

The excitation diagnostic flag is set when any CPU board in the system has an excitation voltage fault (excitation voltage below 4.9 VDC).

Query Command Example:

    DIA.PSEXC
    DIA.PSCEXC=SC3;

The query response SC3 indicates the excitation voltage for a board used by Scale 3 has fallen below 4.9V.

7.2.2   Cell Diagnostic Commands

Cell connection diagnostics are enabled when a cell is assigned to a scale.

Cell Connection Error, <D> = C

The cell connection diagnostic flag is set when one or more load cell wires is disconnected.

> 📝 **Note** *For data formats that include the <S> status token, a cell connection error also sets the status to **I** (invalid).*

Query Command Example:

    DIA.CELLCONNECT
    DIA.CELLCONNECT=SC1 3;

The query response indicates that one or more wires of cell 3 on Scale 1 are disconnected.

> 📝 **Note** *For load cells with a resistance greater than 2,200 Ohms, a high precision 2k Ohm resistor should be placed between the EXC+ and EXC- pins of the load cell connection to maintain correct operation of the Cell Connect diagnostic.*
>
> *Precision resistor properties:*
>
> *Temperature Coefficient ±10 ppm/°C   Tolerance ±1%*

Cell Overload Error, <D> = V

The overloaded cell diagnostic flag is set when the cell output exceeds a specified percentage of full scale cell output set for the scale.

Query Command Example:

    DIA.OVERLOAD
    DIA.OVERLOAD=SC1 100.0% 4:15.233;

The cell overload query, DIA.OVERLOAD, returns information including the affected scale number (SC1), the cell overload threshold (100% of full-scale output), the affected cell number (4:), and the millivolts value of the overload error (15.233 mV).

Threshold Setting Command Example:

The cell overload threshold can be set using the SCs.DIA.OVERLOAD command. Specify the percentage of full-scale output that will trigger the overload error condition.

    SC1.DIA.OVERLOAD=90

The example above sets the overload threshold for Scale 1 to 90% of full-scale output. The threshold can be set to any value from –100 to +100%; the default value is 100%.

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📝 **Note** *The millivolts value of load cell full-scale output can be calculated by multiplying the sensitivity (mV/V) value for the load cell by the excitation voltage of the iQUBE[2] (5 volts). The default sensitivity value is 3.0 mV/V; the default full-scale output is therefore 15 mV (3.0 mV/V * 5 V). Use the LCc.SENS command (where c is the load cell number) to determine the configured load cell sensitivity.*

Cell Under-load Error, <D> = U

The underloaded cell diagnostic flag is set when the cell output falls below the percentage of full scale cell output set for the scale.

Query Command Example:

    DIA.UNDERLOAD
    DIA.UNDERLOAD=SC1 10.0% 3:-2.236;

The cell under-load query, DIA.UNDERLOAD, returns information including the affected scale number (SC1), the cell under-load threshold (10% of full-scale output), the affected cell number (3:), and the millivolts value of the under-load error (–2.236 mV).

Threshold Setting Command Example:

The cell under-load threshold can be set using the SCs.DIA.UNDERLOAD command. Specify the percentage of full-scale output that will trigger the under-load error condition.

    SC1.DIA.OVERLOAD=15

The example above sets the under-load threshold for Scale 1 to 15% of full-scale output. The threshold can be set to any value from –100 to +100 percent; the default value is 10 percent.

7.2.3   Scale Diagnostic Commands

Scale diagnostic commands are dependent on scale configuration and must be explicitly enabled for each scale. Each of the scale diagnostic commands use two or three parameters to set the values used to trigger the associated diagnostic flag.

Cell Mate Relationships

Cell mates to a given load cell are those cells that are adjacent to the cell. In the platform illustration below, LC2 and LC3 are cell mates to LC1; LC2, LC3, and LC6 are cell mates to LC4.
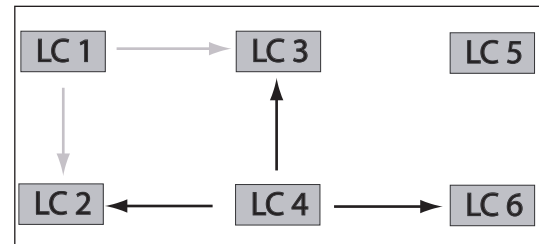
Figure 7-1. Cell Mate Relationships

Zero Reference Error, <D> = R

The zero reference diagnostic flag is set when the output of any cell in a stable scale falls outside the zero reference range configured for the scale.

Query Command Example:

    DIA.ZREF
    DIA.ZREF=SC1 2.0% 4 3.2;

The zero reference query above, DIA.ZREF, returns information including the scale number (SC1), the value set as the zero reference range (as a percentage of scale capacity), and the approximate weight value (3.2) returned for a load cell (4) that exceeds the specified range.

Parameter Setting Commands Example:

    SC1.DIA.ZREF=ON

Enables the zero reference diagnostic test for Scale 1.

    SC1.DIA.ZREF.RANGE=4

Sets the range, as a percentage of scale capacity, of acceptable values for the zero reference diagnostic test to 4% of scale capacity. (That is, the zero reference test will generate errors for weight values exceeding 4% of scale capacity.) The default value is 2 (2%); allowed values are 0–100.

    SC1.DIA.ZREF.THRESH=5

*Sets the threshold for **disabling** the zero reference diagnostic test to 5% of scale capacity. (That is, the zero reference test is not run after the scale has reached 5% of capacity.) The default value is 10 (10%); allowed values are –100 to 100.*

    SC1.DIA.ZREF.TIME=15

Sets the number of seconds to wait before running the zero reference test, after a cell exceeds the specified range value, to 15 seconds. The default value is 10 (10 seconds); allowed values are 0–60 seconds.

Cell Drift Error, <D> = D

The drift diagnostic is used principally for tank and hopper scales that never reach zero.

Query Command Example:

> DIA.DRIFT
> DIA.DRIFT=SC1 2.0% 4:429.4;

The cell drift query above, DIA.DRIFT, returns information including the scale number (SC1), the allowed drift range (2.0% of scale capacity), and the amount of drift, in microvolts, seen by a load cell (4:) that exceeded the specified drift range (429.4 μV).

Parameter Setting Commands Example:

> SC1.DIA.DRIFT=ON

Enables the cell drift diagnostic test for Scale 1.

> SC1.DIA.DRIFT.RANGE=5

Sets the allowed difference in weight, as a percentage of total scale capacity, between the current value on the scale and the value when the previous drift test was run to 5% of scale capacity. The default value is 2 (2%); allowed values are 0–100.

> SC1.DIA.DRIFT.THRESH=5

Sets the threshold for running the cell drift diagnostic test to 5% of scale capacity. (That is, the test for cell drift is not made until the scale reaches 5% of capacity.) The default value is 2 (2%); allowed values are 0–100.

> SC1.DIA.DRIFT.TIME=15

Sets the number of seconds to wait between successive cell drift diagnostic tests to 15 seconds. The default value is 10 (10 seconds); allowed values are 0–300 seconds.

Cell Noise Error, <D> = N

The noise diagnostic flag is set when a single cell experiences noise greater than the configured noise threshold.

Query Command Example:

> DIA.NOISE
> DIA.NOISE=SC1 1.00 1:1.10 3:1.08;

The cell noise query above, DIA.NOISE, returns information including the scale number (SC1), the value set as the system noise threshold (1.00 μV), and the noise values of two cells (1: and 3:) that exceed the threshold (1.10 and 1.08 μV).

Parameter Setting Commands Example:

> SC1.DIA.NOISE=ON

Enables the peak-to-peak noise diagnostic test for Scale 1.

> DIA.NOISE.THRESH=20

Sets the maximum allowable noise threshold to 20 microvolts (μV). The default value is 10 (10 μV); allowed values are 0.01–1000 μV.

> **Note** *Only one noise threshold value can be specified for the entire system. All load cells use the same threshold value regardless of which scale they are attached to.*

> SC1.DIA.NOISE.TIME=15

Sets the number of seconds to wait between successive noise diagnostic tests to 15 seconds. The default value is 10 (10 seconds); allowed values are 0–300 seconds.

Unbalanced Load Error, <D> = L

The unbalanced load diagnostic flag is set when the scale load is not evenly distributed between the load cells. The error can be caused by unbalanced loading of the scale or by non-linear weight distribution caused by scale binding.

Query Command Example:

Given a scale, SC1, with a capacity of 120,000 lb:

> DIA.UNBAL
> DIA.UNBAL=SC1 5.0% 1:17760.0 2:4500.0;

The unbalanced load query above, DIA.UNBAL, returns information including the scale number (SC1), the range of allowed weight variation between cells (5% of scale capacity), and the weight values of cells exceeding the specified range. In this example, the 5% range allowed represents 6000 lb (120000 x 0.05), but cells 1 and 2 exceed that range (17760.0 – 4500.0 = 13260.0).

Parameter Setting Commands Example:

    SC1.DIA.UNBAL=ON

Enables the unbalanced load diagnostic test for Scale 1.

    SC1.DIA.UNBAL.RANGE=10

Sets the allowed difference in weight between load cells to 10% of scale capacity. The default value is 5 (5%); allowed values are 5–75.

    SC1.DIA.UNBAL.THRESH=15

Sets the threshold for running the unbalanced diagnostic test to 15% of scale capacity. (That is, the test for an unbalanced load is not made until the scale reaches 15% of capacity.) The default value is 10 (10%); allowed values are 0–50.

7.2.4   Diagnostic Flag Commands

When data is streamed from the iQUBE[2], the <D> diagnostic code field shows only the highest priority error. The DIA.FLAGS command can be used to show all errors present in the system.

The DIA.FLAGS command returns either an *OK* (no error) response or a scale name followed by a hexadecimal value. The hexadecimal value shows the bits set on for all errors present on that scale.

Table 7-4 lists the mask bits set for each diagnostic error condition. Table 7-5 shows the bits and their associated error conditions as they appear in the hexadecimal value returned by the DIA.FLAGS commands.

For example, if the DIA.FLAGS command returns the following:

DIA.FLAGS=SC2 0x28; SC4 0x20;

Referring to Table 7-5 shows that an overload condition (V) exists on both Scale 2 and Scale 4 (0x20), with a cell connection error (C) also on Scale 2 (0x08).

Because the diagnostic code (<D>) returned from the iQUBE[2] shows only the highest priority error, only the cell connection error (C) would appear in the data.

Mask Bit	<D>	Error Type
—	' '	OK
0x001	P	Power supply error
0x002	S	Secondary connection error
0x004	E	Excitation error
0x008	C	Cell connection error
0x010	R	Zero reference
0x020	V	Cell overload
0x040	D	Cell drift
0x080	U	Cell under-load
0x100	N	Peak-to-peak noise
0x200	L	Unbalanced load

Table 7-4. Mask Bits and Codes for Diagnostic Errors

0x100–0x800				0x010–0x080				0x001–0x008			
8	4	2	1	8	4	2	1	8	4	2	1
—	—	L	N	U	D	V	R	C	E	S	P

Table 7-5. Diagnostic Flag Mask Bits

The DIA.CLEAR command clears all diagnostic flags. The completed command responds with an *OK*.

8.0 Data Formatting

8.1 Weight Data Formats

The following data formats are available for the iQUBE². Each of the listed formats can be customized to suit the application.

Identifier	Default Format
FMT1 (default gross format)	Scale<SC>:<CR><LF>Gross<TAB><G><CR><LF>
FMT2 (default net format)	Scale<SC>:<CR><LF>Gross<TAB><G><CR><LF>Net<TAB><N><CR><LF>Tare<TAB><T><CR><LF>
FMT3 (default polling format)	<SC><POL><W7.><T7.><UNIT><G/N><S><D>
FMT4 (default streaming format)	<STX><POL><W7.><UNIT><G/N><S><CR><LF>
FMT5	<SC><POL><W7.><UNIT><G/N><S> | <T7.> |
FMT6	<SC><POL><W7.><UNIT><G/N><S><D> DIO:<DIO><CR><LF>

Table 8-1. iQUBE² Data Formats

The length of a format string is limited by the length of a serial input value at 128 characters.

8.1.1 Data Format Tokens

Token	Description
<CN>	Consecutive number; do not use for streaming/polling
<CR>	Carriage return character
<D>	Diagnostic event flag character (see Table 8-4 on page 69)
<DA>	Date; do not use for streaming/polling
<ETX>	End of text character
<G>	Gross weight, primary units
<G/A>	Gross weight, secondary units; do not use for streaming/polling
<G/N>	Weighing mode (gross or net)
<LF>	Line feed character
<N>	Net weight, primary units
<N/A>	Net weight, secondary units; do not use for streaming/polling
<NL>	New line character
<NLnn>	New line characters (1–99)
<POL>	Weight polarity
<S>	Status flag (see Table 8-3 on page 69)
<SCn>	Scale number (1–5)
<SP>	Space character

Token	Description
<SPnn>	Space characters (1–99)
<STX>	Start of text character
<SU>	Toggle weight data format (formatted/unformatted)
<T>	Tare weight, primary units
<T/A>	Tare weight, secondary units; do not use for streaming/polling
<T5.>	Tare weight, 5-digit width
<T6.>	Tare weight, 6-digit width
<T7.>	Tare weight, 7-digit width
<T8.>	Tare weight, 8-digit width
<TAB>	Tab character
<TABnn>	Tab characters (1–99)
<TD>	Time and date; do not use for streaming/polling
<TI>	Time; do not use for streaming/polling
<UNIT>	Weight unit character (see Table 8-3 on page 69)
<W5.>	Weight, 5-digit width
<W6.>	Weight, 6-digit width
<W7.>	Weight, 7-digit width
<W8.>	Weight, 8-digit width
<nnn>	ASCII character code

Table 8-2. Data Format Tokens

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8.1.2   Weight Data Status Codes

Table 8-3 lists the weight data status codes used in iQUBE^2 data streams. See Section 8.1.3 for information about diagnostic status codes.

Field	Status Code	Meaning
<POL>	<space>	Positive
	<–>	Negative
	<^>	Over-range
	<]>	Underrange
<UNIT>	L	Pounds
	K	Kilograms
	T	Tons
	M	Metric tons
	G	Grams
	O	Ounces
	R	Grains
	<space>	None
<G/N>	G	Gross
	N	Net
	g	Emulated gross
	n	Emulated net
<S>	<space>	Valid
	I	Invalid
	M	In Motion
	O	Over/underrange
	Z	Center of zero

Table 8-3. Weight Data Codes

8.1.3   Diagnostic Codes

When using the diagnostic data stream, only one diagnostic status code is returned for the scale in a single data frame. The diagnostic codes shown in Table 8-4 are listed in order of importance, from most critical to least critical error type; only the most critical diagnostic code is returned in the data stream.

> **Note**   *All current diagnostic errors can be queried using the diagnostic serial commands (see* Section 6.0 on page 56*).*

Field	Status Code	Meaning
<D>	P	Power supply
	S	Secondary communication
	E	Excitation
	C	Cell connection
	R	Zero reference
	V	Overloaded cell
	D	Drift
	U	Underloaded cell
	N	Peak noise
	L	Unbalanced cell
	<space>	No error

Table 8-4. Diagnostic Status Codes

8.2   Data Formatting Examples

8.2.1   Formatting Data from Multiple Scales
Data from multiple scales can be streamed or polled using one or several formats, to one or more comm ports.

Example, given a four-scale system with the following data format assigned to FMT1:

> FMT1=<SC><P><W7.><S>

All four scales can be set up to stream data to the same communications port (COM1).

> SC1.STREAM=COM1
> SC2.STREAM=COM1
> SC3.STREAM=COM1
> SC4.STREAM=COM1

All four scales can also be set up to stream data using FMT1.

> SC1.SFMT=FMT1
> SC2.SFMT=FMT1
> SC3.SFMT=FMT1
> SC4.SFMT=FMT1

This configuration will output a string of four concatenated FMT1 frames, one for each scale. Assuming all scales are at zero, the output at COM1 might look like the following:

> 1   0Z 2   0Z 3   0Z 4   0Z

8.2.2   Using the Start/Stop Streaming Commands
The SX (start streaming for all scales) and EX (stop streaming for all scales) can be used to toggle streaming and off for the scale system. Individual scale output can also be included or excluded from the streamed output using the SC*s*.SX and SCs.EX commands to start or stop the output from Scale *s*.

Example: given the four-scale concatenated stream described above, Scale 1 could be excluded by using the SC1.EX command:

> 2   0Z 3   0Z 4   0Z

Or, to restore the Scale 1 output but exclude Scale 3 output from the streamed data:

> SC1.SX
> SC3.EX

> 1   0Z 2   0Z 4   0Z

8.2.3   Encapsulating Data with Prefix and Postfix Characters
Prefix and postfix characters can be added to streamed or polled output from a specified communications port. Specify the decimal value of the ASCII character to add on the prefix and postfix character commands shown below:

> COM1.STRM.PREF=2
> COM1.STRM.POST=3

> <STX>1   0.00Z SCALE2:   0.00   0.00Z DIAG:.<ETX>

9.0   Maintenance and Troubleshooting

9.1   Cell Emulation

Cell emulation allows the output of a failed load cell to be emulated by using the remaining cells in the system to estimate the value of the failed cell. The calculation of the emulation value depends the calibration type used to calibrate the scale. The performance of the emulation for the three calibration types: *2-POINT*, *CORNERMATCH* and *SECTIONMATCH* may vary drastically by application. The following guidelines are presented to help select the proper calibration type and get the best possible performance from your scale if emulation is being used.

> 📝 **Note**   *Cell emulation is not Legal for Trade.*

9.1.1   Section Match

Section match calibration is used primarily on truck scales. Truck scales use the concept of sections to describe a scale. A section is a pair of cells directly across from each other on the scale. In load cells 1 and 2, 3 and 4 and 5 and 6 make up the three sections of the scale. The trimming/calibration process requires trimming the scale one section at a time, therefore three calibration measurements should be made. One between cells 1 and 2, one between cells 3 and 4 and one between 5 and 6.

Section match works best when both cells in a section have the same capacity and sensitivity and the load on the scale will normally be placed along the center line of the scale (with respect to the two cells in a section).

Figure 9-1. Example of scale sections

Emulation performance on section match type scales is highly dependent on the ability of the operator to position the center of gravity of the load along the center line of the scale.
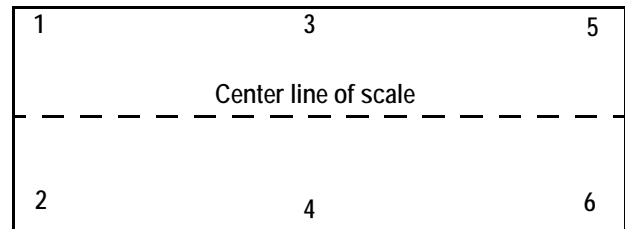
9.1.2   Corner Match

Corner match calibration can be used on any scale base with two or more cells. It is increasingly effective as the number of load cells in the system increases. Trimming/calibrating the scale requires one measurement for each load cell in the system with the weight placed directly over the load cell to be trimmed.

Corner match works best on truck scales with 8 or more load cells and on rectangular or odd-shaped bases where the typical load on the scale cannot be easily centered with respect to all load cells on the system.

Corner match type scales provide the best emulation performance on bases with a larger number of cells (e.g., truck scales with 8 or more cells). On smaller bases with 5 or fewer cells, it provides the best average emulation performance when the center of gravity for the load cannot be easily centered with respect to all the load cells in the system (e.g., loads with small footprints on a large base).

9.1.3   2-Point

2-point calibration can be used on any scale base when no trimming is needed. Calibration requires only a zero and span measurement.

2-point is the only calibration type that can be used on single load cell or pre-trimmed (analog J-Box) type scales. On multi-cell systems, 2-point works best on bases where the load's center of gravity will normally be centered with respect to all load cells. This is especially true for tank and hopper scales.

2-point emulation is not allowed on scales defined by a single load cell or bases with a single load cell or pre-trimmed (analog Junction Box). On multi-cell systems, emulation performance is highly dependent on the ability to center the load with respect to all the load cells in the system. In general, the closer the load footprint size is to the size of the deck, the better the emulation performance will be.

9.1.4   Cell Emulation in Virtui2

To enable cell emulation in Virtui2:

1. Log in to the Virtui2 Configuration Utility as a user with administrator rights (see Section 5.2 on page 50).

2. If the bad load cell needs to be identified, use the *Diagnostics Monitor* in the *Tools* menu to make that determination.

3. From the *Tools* menu, select **Cell Emulation**.

4. From the list of scales on the left side of the *Cell Emulation* dialog box, click the scale containing the bad load cell.

5. From the *Simulated Cell* list, click the load cell to be emulated.

6. Click the **Download** button to enable emulation for the selected load cell.
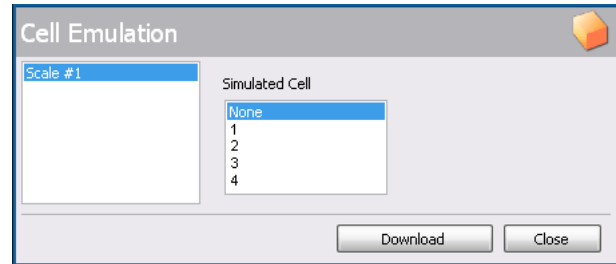

Figure 9-2. Cell Emulation Dialog Box

9.1.5   Cell Emulation with 920i Indicator

1. When a load cell error occurs press the **diagnostic** Softkey to view the diagnostic screen.

2. Used the up and down arrows to navigate to the load cell with the error.

3. Press the **Cell Emulation** softkey to simulate that load cell.

> **Note** *Only 1 cell may be emulated per iQUBE² Scale.*

9.2   Power Considerations

The iQUBE² can be powered either by the internal power supply (PN 76556) or by an external DC power supply. iQUBE² CPU boards accept input voltages in the range 6–12 VDC.

AC Powered Option (PN 76556)

The iQUBE² circuit boards are optimized to receive power from the internal 7.5 VDC power supply (PN 76556). This option provides 25 watts of power, with continuous current of 3.33 amps, and can power a complete 16-channel system under typical conditions. The internal power supply requires AC power to be available at the scale, but offers the greatest protection from inductive transients.

DC Powered Option (PN 108434)

The approved remote 12 VDC power supply for the iQUBE² (PN 108434) provides 44.4 watts of power, with continuous current of 3.7 amps, to power a full system over typical distances from scale-house to scale. The remote power supply is mounted in an 8 x 6 x 4-inch NEMA Type 4X FRP enclosure and includes a transient protection board, PN 110949.

The transient boards will handle the maximum current provided by the power supply, but large current loads increase the voltage drop across the inductive chokes and could reduce the input voltage to the iQUBE² system below the 6 VDC minimum. See Section 9.2.2 on page 73

9.2.1   System Current Draw

Tables 9-1 and 9-2 show the current requirements for the iQUBE² CPU board and communications options cards. System current draw is the sum of the individual current requirements.

CPU Board Loads	Current Draw
Nominal CPU board load	360 mA
Per 700 Ω load cell	17 mA
Per 350 Ω load cell	24 mA
Per summed platform (4 x 350 Ω load cells)	60 mA
Per I/O channel (maximum)	25 mA

Table 9-1. CPU Board Current Draw

Option Card PN	Option Description	Current Draw
77143	Fiber-optic card	25 mA
77142	Ethernet card	195 mA
108671	Wireless LAN card	320 mA
93245	USB card	27 mA
108579	Serial expansion card	100 mA

Table 9-2. Communications Option Card Current Draw

Current Draw Example:

The current requirements for a truck scale system using 10 x 700 Ω load cells and a fiber-optic communications card would be calculated as follows:

- 3 x CPU boards @ 360 mA each = 1080 mA
- 10 x 700 Ω load cells @ 17 mA each = 170 mA
- 1 x fiber-optic card @ 25 mA = 25 mA

The sum of these current requirements gives:

1080 mA + 170 mA + 25 mA = 1275 mA

9.2.2   System Voltage Drop

Once the current draw of the system is calculated, the voltage input to an externally-powered iQUBE^2 system can also be calculated.

The primary sources of voltage drop in an externally powered iQUBE^2 system are the transient boards and the power cable. Both voltage drops are directly proportional to the current draw of the system being powered.

Transient Board Voltage Drop

The inductive chokes on the transient boards have a resistance value of 0.08Ω. With two chokes per board (voltage source and return path), the effective resistance per board is 0.16Ω.

Current Load	Transient Board Voltage Drop
1.0 A	0.16 V
1.5 A	0.24 V
2.0 A	0.32 V
2.5 A	0.40 V
3.0 A	0.48V

Table 9-3. Transient Board Voltage Drop

Power Cable Voltage Drop

Power cable voltage drop is a function of the type of cable used and the length of the cable run. *The run length includes both the supply and return lengths*.

Stranded Wire Gauge	Ω per Foot
20 ga	0.01015
18 ga	0.00639
16 ga	0.00402

Table 9-4. Common Cable Resistance Values (Ω/ft)

Note *Cable resistance is also a function of temperature. Values given assume an ambient temperature of 25°C (77°F).*

Voltage Drop Example

Using the total system current draw from the truck scale current draw example above (Section 9.2.1 on page 72), the voltage drop for an externally-powered system can be calculated.

Given that the current draw is 1.275A (1275 mA); the power cable is 20-gauge stranded wire; and the iQUBE^2 at the scale is located 200' from the 12 VDC supply in the scale house, three voltage drops can be calculated:

- Power supply transient board voltage drop: 1.275A x 0.16W = 0.204V
- Power cable voltage drop: 1.275A x 0.01015W/ft x (2 x 200ft) = 5.177V
- iQUBE2 transient board voltage drop: 1.275A x 0.16W = 0.204V

Total voltage drop is: 0.204V + 5.177V + 0.204 V = 5.585 V

Effective power supply voltage seen at the iQUBE2 is then: 12V – 5.585V = 6.415V

This voltage is acceptable, but the power cable voltage drop could be cut in half by using two 20-gauge wires for the supply and return cable runs. Cabling can be doubled by wiring to both V+ terminals and both V– terminals on the transient board connectors. In this example, reducing the cable voltage drop to 2.589V would result in an effective input voltage of 9.003V.

9.3   Installing Firmware Updates

The iQUBE^2 Flash Updater application is automatically installed with Virtui2. If using Virtui2, the iQUBE^2 Flash Updater can be run by clicking *Start » All Programs » Rice Lake Weighing Systems »* iQUBE^2 *Flash Updater*.

Note *Because the iQUBE^2 Flash Updater uses the same port as Virtui2, the Virtui2 services must be stopped before the iQUBE^2 Flash Updater can execute a firmware update. To stop Virtui2 services, open Services by doing one of the following:*

From the Windows Start menu, select Run..., type services.msc *in the prompt, then click OK.*

From the Windows Start menu, select Control Panel, open Administrative Tools, then open Services.

Select Services from the Virtui2 Configuration Utility Tools menu.

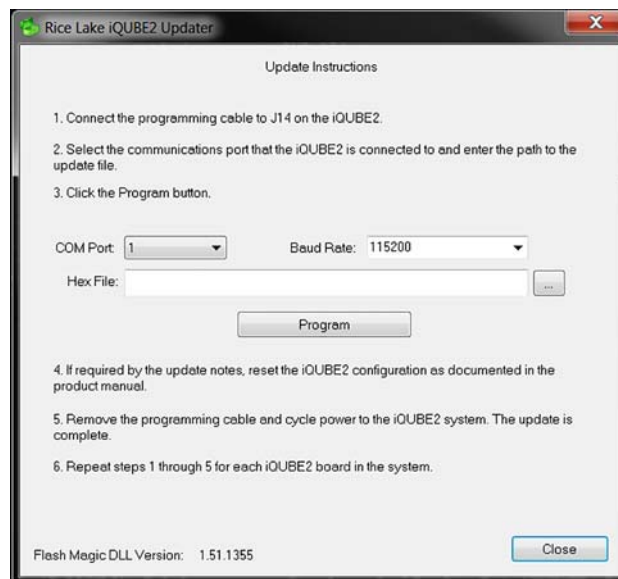*Then, right-click on each Virtui2 service and select STOP.*

Figure 9-3. Flash Updater

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1. Connect the programming cable to the J14 connector. See Table 9-5.
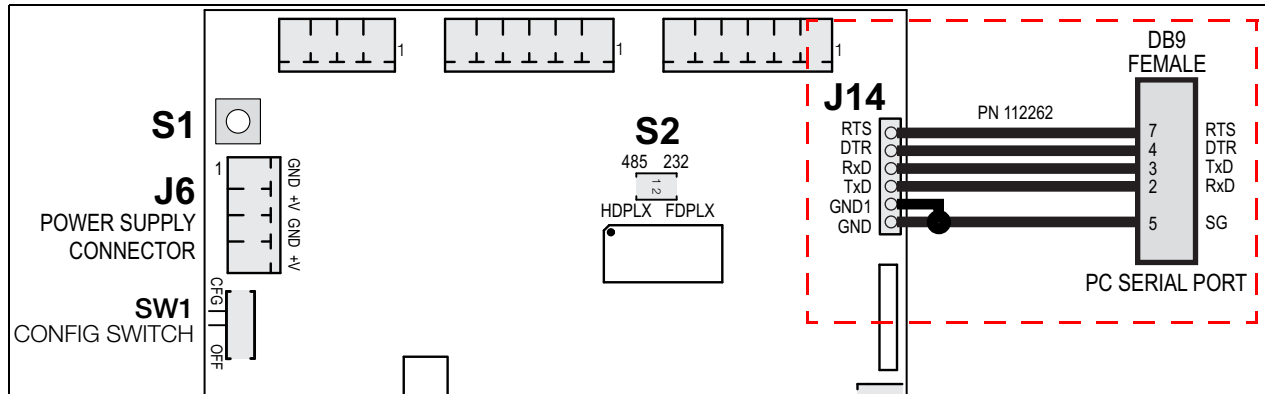
Figure 9-4. Host Connection to iQUBE² CPU Board

iQUBE² J14 Connections		DB-9 Female Connector	
Pin	Signal	Pin	Signal
1	GND	5	GND
2	GND1	NC	—
3	TxD	2	RxD
4	RxD	3	TxD
5	DTR	4	DTR
6	RTS	7	RTS

Table 9-5. Host Communications DB9 Connections

2. In the iQUBE² Updater, use the *COM Port* pull-down menu to select the communications port of the PC that the iQUBE² is connected to.

3. If necessary, use the *Baud Rate* pull-down menu to specify a different baud rate.

4. Click the ellipses (...) to browse to and select the iQUBE² firmware file (.hex extension).

5. Click the **Program** button. Programming may take up to 1 minute to complete.
    A confirmation dialog box appear when the firmware update is complete.

6. Remove the programming cable from the J14 connector.

If Virtui2 Services were stopped prior to the firmware update, restart them. Use the instructions found earlier in this chapter to access Services, then right-click on the two Virtui2 services and select START. **Note**

9.4   Replacing CPU Boards

Replacing a board is best done by modifying a stored system configuration that was uploaded from the system's primary CPU board via Virtui2 Configuration Utility.

9.4.1   Replacing the Primary CPU Board

1. Load the stored configuration for the system into the RLWS configuration utility.

2. Remove power from the iQUBE² system.

3. Remove the primary CPU board to be replaced. Label the load cell cables to ensure the load cell connectors will be plugged into the same connectors on the replacement CPU.

4. Install the new CPU board by connecting the system exactly as it was with the old board.

5. Connect power to the system and place it in SETUP mode by moving SW1 to the CFG position (see Figure on page 7).

6. Connect iQUBE²'s primary CPU using the system configuration utility.

7. Manually type in the new board ID (see Section 5.1 on page 46) or delete the existing board ID.

8. Download the stored configuration file to the iQUBE^2, then return SW1 to the OFF position.

9.4.2   Replacing a Secondary CPU board

1. Load the stored configuration for the system into the RLWS configuration utility.

2. Remove power from the iQUBE^2 system.

3. Remove the secondary CPU board to be replaced. Label the load cell cables to ensure the load cell connectors will be plugged into the same connectors on the replacement CPU.

4. Install the new CPU board by connecting the system exactly as it was with the old board.

5. Connect power to the system and place it in SETUP mode by moving SW1 to the CFG position (see Figure on page 7).

6. Connect iQUBE^2's primary CPU using the system configuration utility.

7. In the configuration utility, find the ID of the secondary board that was replaced in the list of Secondary IDs.

8. Highlight the field that contains the old 8-digit hexadecimal ID and type the 8-digit hexadecimal ID of the new board (not case-sensitive).

9. Download the stored configuration file to the iQUBE^2, then place the system in WEIGH mode by moving SW1 to the OFF position.

9.5   Troubleshooting

The following section provides information to assist for troubleshooting or repairing the iQUBE^2.

Materials needed to accomplish these steps are:

-   1280, 920i or Virtui2 Configuration Utility loaded onto a PC
-   Digital voltmeter

9.5.1   General Steps

To determine that the iQUBE^2 has power, check LED HB1 on the core module and LEDs for the load cells assigned on each connector board (see Figure 2-1 on page 6).

Use a voltmeter to measure the voltage at connector J6. Pin 1 should show at least 6 volts.

Verify communication LED5 on the core module is flashing.

If using Virtui2, if the iQUBE^2 CPU board's power and LEDs are all properly lit, launch the Diagnostic Monitor from the Virtui2 *Configuration Utility Tools* menu to run diagnostic tests and view errors. Launch the Cell Monitor from the *Tools* menu to view the outputs of each load cell.

If the configuration looks good, check the outputs of each load cell. Cell outputs should change when a weight on top of each cell or when the load cell cable is disconnected.

If these steps do not resolve the problem, contact Rice Lake Weighing Systems technical support for further assistance.

9.5.2   Troubleshooting

Symptom	Cause/Remedy
iQUBE^2 seems dead	Cycle power on the iQUBE^2 and check that HB1 is blinking green.
No LEDs lit for load cells	Ensure SW1 is set to OFF, or a download from Virtui2 is required after setup is completed.
Some LEDs lit green or red	Green light means good configuration and good cell; red indicates a load cell fault or bad A/D conversion. Swap load cell cable to another position.
No scale or iQUBE^2 in host device configuration	Configuration setup and download needed to setup configuration the iQUBE^2 (see Section 3.1 on page 21). Ensure setup switch (DIP switch 4 on the core module) is ON to enable download from host device to iQUBE^2.
Very large trim factors	Verify that the capacity and sensitivity of each configured load cell is correct.
Cal-Match failure	Check CalType for proper calibration type.
Calibration shift	Possible mechanical problem or corrupted data stored in iQUBE^2. If another device connected to the iQUBE^2 causes this, check for proper common grounding.
No communication	In setup of iQUBE^2, press the **Connect** softkey to verify communications (see Section 3.1.1 on page 22. This step retrieves the serial numbers of the attached iQUBE^2 units for verification. Check communication wiring and switches 5 and 6.
No communication with secondary unit	Perform the MS.AUTO function or assign secondary units through Virtui2.
No fiber-optic communication	Check for damaged fiber cable. Verify proper connection of transmit to receive. Check RS-232 communications to determine if the communications failure is limited to the fiber communications board.
No Ethernet communication	Verify IP address and connections. Try to connect using Telnet software.

Table 9-6. iQUBE^2 Troubleshooting

9.6   Specifications

AC Model Power

Line Voltages	115 or 230 VAC
Frequency	50 or 60 Hz
Current Draw	2 A (max per 4 CPU system)

DC Model Power

Input Voltages	6 - 12 VDC
Current Draw/Board*	520 mA (max) @ 7.5VDC

*Does not include installed option card

A/D Specifications

Excitation Voltage	5 VDC (Single Sided)
	16x350Ω
Input Range	± 78 mV
Signal Sensitivity	0.3 µV/grad @ 30Hz
	0.5 µV/grad @ 100Hz
	1.2 µV/grad @ 500Hz
A/D Sample Rate	2.5 - 500 Hz (Selectable)
Input Impedance	> 1 MΩ typical
Internal Resolution	16,777,216 Counts
Input Sensitivity	10 nV per internal count
Display Resolution	100 000 dd
System Linearity	Within 0.01% of full scale
Zero Stability	150 nV/°C, maximum
Span Stability	3.5 ppm/°C, maximum
Transient Protection	600 W Bi-directional

Scale Update Rates (Streaming)

1 CPU	500 per second (typical max)
2 CPU	190 per second (typical max)
3 CPU	130 per second (typical max)
4 CPU	80 per second (typical max)

Digital I/O Specifications

Number of Channels	4 Configurable
Transient Protection	300 W Bi-directional
Electrical/Channel	25mA @ 5 V TTL (Active Low)

Input

Configurations	ZERO, TARE, NT/GRS, UNITS, PRINT, CLRCN,CLRTAR
Read Time	5 ms (typical)

Output

Configurations	SETPNT, CELHLTH, HOSTCTL
Write Time	5 ms (typical)

Serial Communications

Port 1	RS-232/422/485
	9,600 - 460,800 Baud
Port 2 Options:	Fiber-Optic, Ethernet,
	Wireless Ethernet, USB,
	RS-232/422/485
	9,600 - 460,800 Baud
M/S Port	RS-485 (2-wire)
	450,000 Baud

Environmental

Operating Temperature	-10 to +40°C (legal);
	-25 to +60°C (industrial)
Storage Temperature	-25 to +70°C
Humidity	0-95% relative humidity

Enclosures

Enclosure Dimensions	
Weight	lb (Kg)
Rating/Material	NEMA Type 4X

Certifications and Approvals

NTEP

CoC Number	03-032A1
Accuracy Class	III/IIILn_{max} : 10 000

UL

File Number:	E151461, Vol. X1 and X2

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