CryoScan® 60
Remote Telemetry System

User Manual
Part No. 2350129-01, Rev. 02
November 2011

N 19511

CONTENTS

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Manual No. 2350129-01, Rev. 02
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SAFETY

Before installing this instrument, become familiar with the installation instructions in Section 2.

DANGER notes indicate the presence of a hazard which will cause severe personal injury, death, or substantial property damage if warning is ignored.

WARNING notes indicate the presence of a hazard which can cause severe personal injury, death, or substantial property damage if warning is ignored.

CAUTION notes indicate the presence of a hazard which will or can cause moderate personal injury or property damage if warning is ignored.

DANGER, WARNING, and/or CAUTION notes that appear on the following pages of this manual should be reviewed before proceeding: 18, 25-28.

Section 1—Introduction

General

The CryoScan® 60 (CS60) Remote Telemetry Unit is the hub of the CryoScan® Telemetry System, designed to automate the management of cryogenic tank levels. The CS60 uses either differential pressure measurements from a CS60 sensor or 4-20 mA outputs from customer-supplied sensors to indicate tank levels. The CS60 can be powered with a solar panel or an AC supply.

The differential pressure sensor measures pressure at points near the top and bottom of a tank. The CS60 electronics then process the data relative to the shape and dimensions of the tank to provide accurate level and pressure measurements.

Measurement data is transmitted to a remote host computer via an internal land line or cellular modem. CryoScan® PC, a software package sold separately by Cameron, allows a user to monitor tank levels and pressures and establish alarms to ensure that minimum product levels are maintained at all times.

Specifications

Measurement Accuracy	±0.25% of full scale over operating temperature range
Sensor	316 stainless steel, brass, copper or anodized aluminum wetted parts; Fluorinert fill fluid; 1/4-in. NPT process connections on 2 1/8-in. centers
Calibrated Sensor Ranges	Level: 1000 inches H2O (2.5 bar) Pressure: 575 psig (40 bar)
Sensor Pressure Ranges	Maximum working pressure: 575 psi
Operating Temperature	-40°F to +158°F (-40°C to +70°C)
Inputs (Standard Unit)	Integral sensor
Inputs (With I/O Board Option)	Six 4-20 mA inputs (external supply required for solar version) Two contact closure (status) inputs
Outputs (With I/O Board Option)	Two 4-20 mA (external supply required for solar version) Two latching relays
Minimum Measurement Interval	5 seconds (AC) or 1 minute (solar)
Datalog Capacity	800 (each datalog contains all inputs)
Alarms	Two user-selectable alarm setpoints for tank level and pressure inputs (DP, SP and 4-20 mA); a configurable alarm for a change in a contact closure condition
Reporting Interval	User-selectable daily call-out/ call-in times for receiving RTU status reports; “Poll on demand” reports for instantaneous RTU status checks

Communications	Landline (V.90) modem (for AC-powered units only) Cellular GSM modem (CSD or GPRS), external antennas optional USB (local configurations) RS-232 or RS-485 (host interface)
Display	Configurable LCD, supports up to 8 inputs, 0.7-in. characters, backlight on AC version
Interface Software	CryoScan® PC Software
Power	12V, 10-watt solar panel with rechargeable battery (device also supports a 6V 10-watt panel) AC power (100-240 VAC) with backup battery Autonomous battery power without recharge: 7 days, minimum
Enclosure	Dimensions: 7.7 in. (width) x 9.8 in. (height) x 5.77 in. (depth); NEMA 4X/IP66, mounting hardware included
Approvals	CE Approved C-Tick, A-Tick Approved AC Power Supply - UL, TUV, and CB; EN60950, IEC60950 and UL60950-1 Landline Modem - FCC Parts 15 & 68, IC-CS03, CTR21, and UL; GSM Modem - R&TTE, FCC, UL, IC, GCF, and PTCRB

Components

Display

The configurable display can be used to monitor up to eight inputs. The display can be configured to display one input at a time, with the value and engineering unit displayed in separate readouts (Figure 1.1, page 7). Alternatively, it can be configured to display two inputs at a time, one in each readout.

Enclosure

The CS60 can be wall-mounted or pole-mounted. A set of U-bolts is supplied with each unit. For complete mounting dimensions, see Figure 1.6, page 11.

Four conduit entry ports are provided in the bottom of each enclosure (Figure 1.2, page 7). Cord grips are supplied to facilitate field wiring (number and locations vary with the configuration). All unused openings are fitted with rubber seals.

Sensor

The standard CS60 features an integral differential pressure sensor, mounted to the back of the enclosure and factory-wired to the main circuit board. External sensors are optionally available for monitoring up to four tanks with a single CS60. For installations using AC power and 4-20 mA inputs for tank measurement, a no-sensor CS60 configuration is also available.

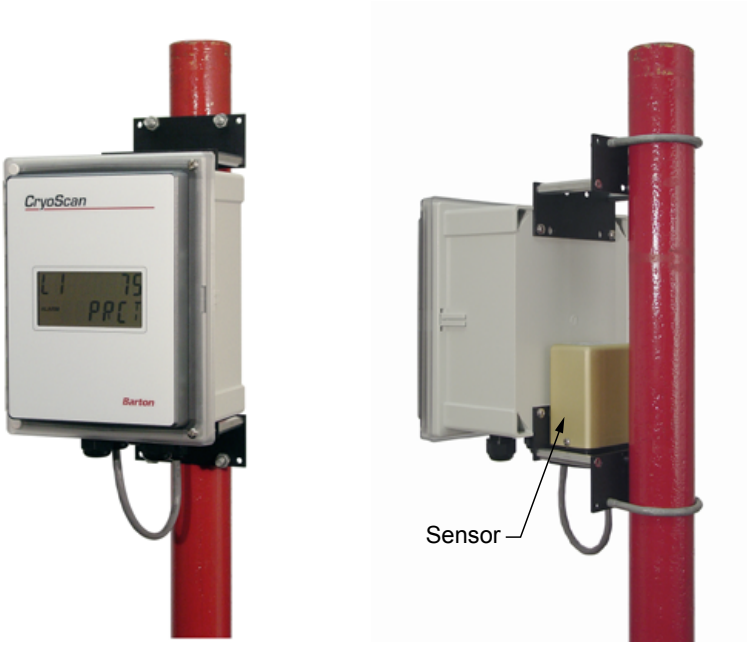


Figure 1.1—CS60, external view

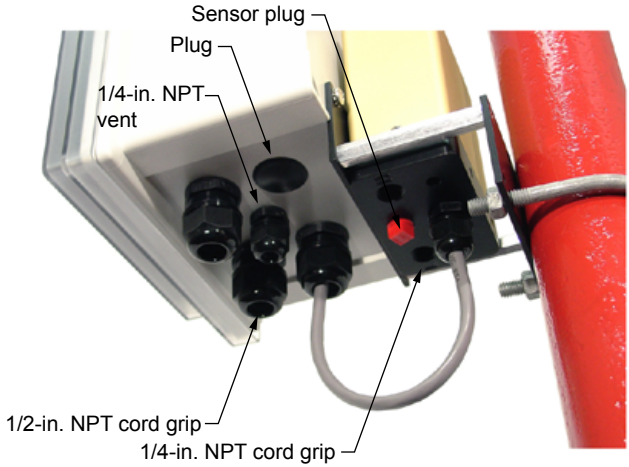


Figure 1.2—CS60 conduit openings (AC version with three cord grips and one plug shown; solar version has two cord grips and two plugs)

Circuitry and Power Supplies

Inside the enclosure is a main circuit board, mounted inside the door, and a rechargeable battery pack. AC-powered assemblies contain a 24V power supply (Figure 1.3, page 9). Solar-powered assemblies are equipped with a 10-watt solar panel, a solar panel mounting bracket, and an antenna, mounted on the inside wall of the enclosure (Figure 1.4, page 9). The solar panel can be purchased in two cable lengths— 9 ft or 35 ft—to accommodate various installation needs. The CS60 can also be powered with the 6V solar panels sold with previous CryoScan® devices.

Modem

A modem is required for transmitting data remotely. AC-powered CS60 users can choose from a landline or cellular (CSD or GPRS) modem. Solar-powered devices require cellular (CSD or GPRS) modems. All CSD or GPRS modem units include an internal antenna (Figure 1.5, page 10). External directional antennas are available separately. See External Directional Antennas, page 34.

Optional Features

I/O Board

Existing sensors can be used to provide measurement inputs to the CS60 by adding an optional I/O board and customer-supplied 4-20 mA transmitters. For solar installations, the 4-20 transmitters must have an external power source. When an I/O board is used with remote sensors, the number of analog inputs available on the I/O board is reduced by two per sensor.

Heater

An optional heater is also available for AC-powered units only. The heater may be desired for cool, moist climates, but is not typically required for operation.

Oxygen Cleaning

Oxygen cleaning is also available for both AC-powered and solar-powered units.

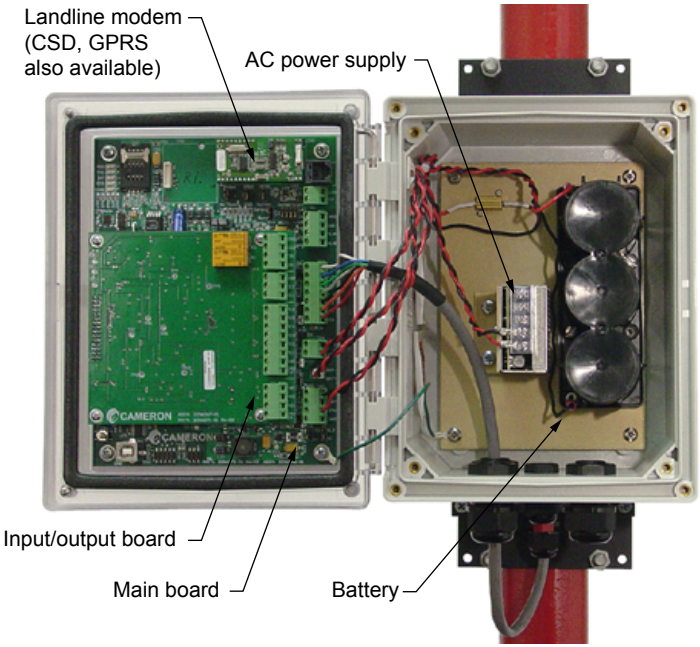


Figure 1.3—Internal components, AC-powered device

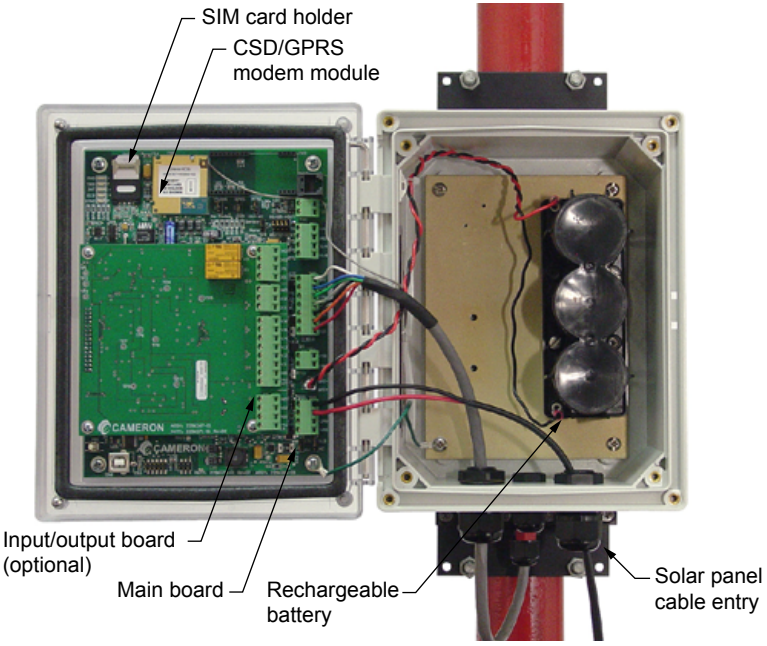


Figure 1.4—Internal components, solar-powered device

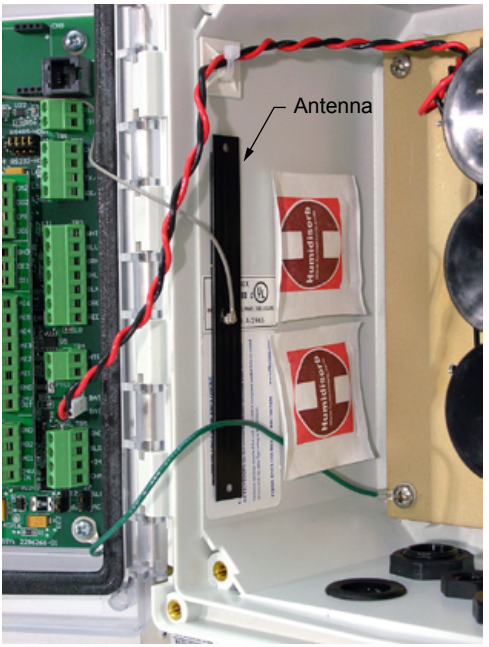


Figure 1.5—Antenna for cellular modem device

Accessories

A variety of accessories are also available for use with the CS60. They include:

- remote sensors
- remote sensor mounting kit
- bulk sensor cable for mounting remote sensors
- CryoScan® PC software (standard full configuration and lite "read only" versions)
- external directional antenna
- external directional antenna adapter
- antenna extender cable (for allowing the antenna to be placed up to 100 ft away from the CS60)
- engineering unit label set for customizing the front display

These accessories are discussed in more detail in Section 5 (Maintenance) and Appendix B (Sensor Wiring). Part numbers are provided in Section 5 as well.

Dimensions

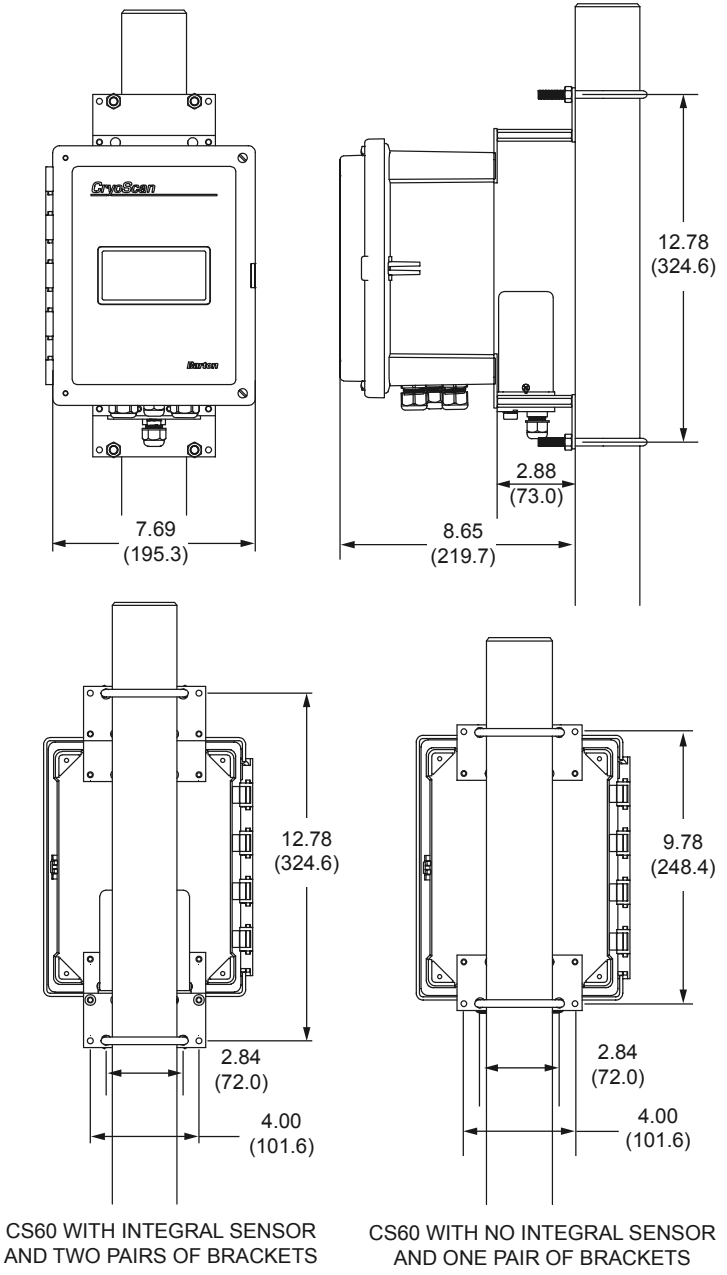


Figure 1.6—CS60 dimensions, inches (mm)

Section 2—Installation

General Preparation

Before installing the CS60, review the following considerations:

1. Inspect the instrument during unpacking to detect any damage that may have occurred during shipment.
2. Determine the ideal location for the CS60, considering factors such as:
   - space restrictions
   - cellular communications restrictions as appropriate
   - visibility of the display
   - proximity to the solar panel or AC power supply as appropriate
3. Review the instructions in this document for the following steps and acquire all necessary tools for performing them:
   a. Install a solar panel, if solar power is required.
   b. Mount the CS60 to a wall or a pole (a set of U-bolts is provided).
   c. Connect piping from the tank to the sensor.
   d. If the CS60 is AC-powered, install a switch or circuit breaker at the AC power source as close as possible to the installed unit so the power can be turned off for service or maintenance of the unit.
   e. Install optional external sensors, if applicable.

Preparations for GSM Modem Users

A SIM card and an appropriate GSM cell plan must be obtained before installing a GSM modem-equipped CS60. If GPRS communications are to be used, verify that the SIM card supports GPRS communications.

For GPRS communications, an SMS messaging account is required for enabling the host computer to initiate communications with the RTU.

See also External Directional Antennas, page 34, for information on maximizing cellular reception in remote areas.

Solar Panel Installation

Mount the solar panel assembly to a pole or wall, using the supplied adjustable mounting bracket and manufacturer's instructions. The mounting bracket supplied with the 10-watt panel has two pivot points which allow the position of the solar panel to be adjusted after the assembly is mounted (Figure 2.1, page 14).

Figure 2.1—Fully assembled solar panel

Solar Panel Installation Best Practices

- Ensure the solar panel is appropriately sized for the geographical location and weather conditions.
- Avoid locations where shadows will significantly reduce the number of direct sunlight hours the solar panel will receive each day. It should not be mounted in areas shaded by structures, equipment, trees, or other objects (Figure 2.2).

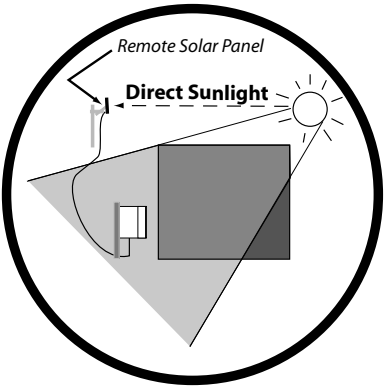
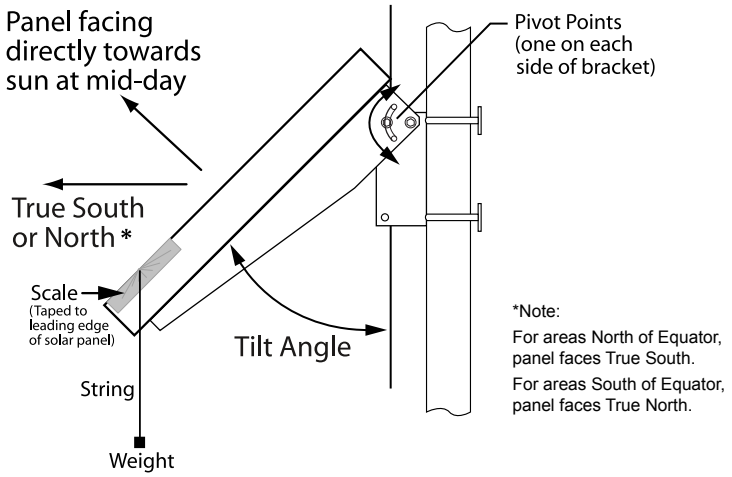


Figure 2.2—Solar panel placement (direct sunlight)

Solar Panel Orientation

For optimum performance, adjust the angle of the bracket in accordance with the sun's location as follows.

1. Position the solar panel so that it is oriented in accordance with its geographic location. North of the equator, the solar panel should face true south. South of the equator, the solar panel should face true north.
2. Determine the latitude of the solar panel installation location from a map, internet map service, or GPS instrument.
3. Use the latitude to determine the appropriate tilt angle for the solar panel (see the Typical Latitude/Correction Angle chart in Figure 2.3). This tilt angle orients the solar panel in the direction of the midday sun during the winter months. While the sun's position changes throughout the year, this position ensures the most energy from the panel over the course of a year.



Solar Panel Orientation
Tilt Angle = 90 - (Latitude * 0.89 + 24)

Typical Latitude/Correction Angle

Location	Latitude (°)	Tilt Angle (°)
Mexico City, Bombay	20	48
Key West, Taipei	25	44
Houston, Cairo	30	39
Albuquerque, Auckland	35	35
Denver, Madrid	40	30
Minneapolis, Milano	45	26
Winnipeg, Prague	50	21

Figure 2.3—Solar panel orientation

4. Loosen the pivot point of the solar bracket and tilt the solar panel to the prescribed angle as follows.
   a. Make a photocopy of the Solar Panel Orientation Scales printed on the inside back cover of this manual) and cut out one of the scales. Trim as needed to align the top edge of the scale with the front face of the solar panel. Tape the scale to the side of the solar panel as shown in Figure 2.4.
   b. Attach one end of a string to the top center point on the scale (small black circle in Figure 2.5) and a weight to the other end of the string (large white circle in Figure 2.5).
   c. Pivot the solar panel until the string aligns with the desired angle on the scale.

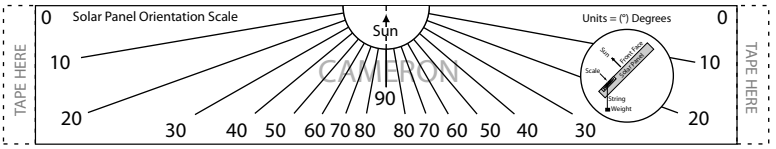


Figure 2.4—Solar panel orientation scale sample
(use full-size scales on inside back cover to attach to a solar panel)

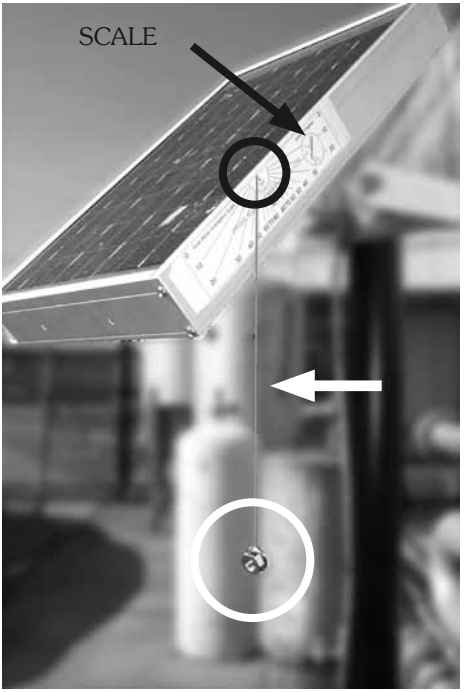


Figure 2.5—Solar panel orientation scale

4. Tighten the pivot point bolts on the solar panel bracket to prevent movement.
5. Remove the scale, string, and weight.

CS60 RTU Installation

The CS60 can be wall-mounted or pole-mounted as shown in Figure 2.6. A pair of U-bolts is included with each shipment.

Check to see that the mounting location is free from obstructions that would prevent a clear view of the display or interfere with cellular communication, if applicable.

Figure 2.6—Mounting options—pole mount (left) or wall mount (right)

Antenna Connection

The dipole antenna provided with the standard GSM modem unit is factory-installed along the left inside wall of the CS60 enclosure and connected to the GSM modem board (Figure 1.5, page 10).

To determine if an external antenna installation is required, observe the "rSSI" value displayed on the LCD during startup. This value represents the strength of the cellular signal received from a cellular tower. A value of 9 or higher is considered acceptable for cellular reception. A value below 9 indicates an inadequate signal strength; the operator should consider purchasing an external directional antenna (see External Directional Antennas, page 34).

The "rSSI" value is also displayed in CryoScan PC configuration software (on the RTU Status screen, RTU Info tab), assuming that the antenna signal strength is sufficient to establish a connection between the CS60 and the software.

Sensor Piping Installation

WARNING **PRESSURE HAZARD. BEFORE ATTEMPTING TO DISASSEMBLE THE RTU OR REMOVE A SENSOR PORT PLUG, MAKE CERTAIN THAT THE SYSTEM LINES TO THE SENSOR ARE NOT PRESSURIZED.**

Use Teflon® tape or other approved sealant on all sensor piping connections, and plumb the sensor from the bottom, as shown in Figure 2.7. In oxygen applications, make sure the sealant complies with corporate regulations and/or approvals. A 4- or 5-valve manifold (or equivalent) is recommended to allow calibration and removal of instrument without depressurizing the entire system.

Connect a pipe from the bottom of the tank to the high-pressure sensor port. Connect a second pipe from the top of the tank to the low-pressure sensor port. Add piping as required to facilitate manifold valves.

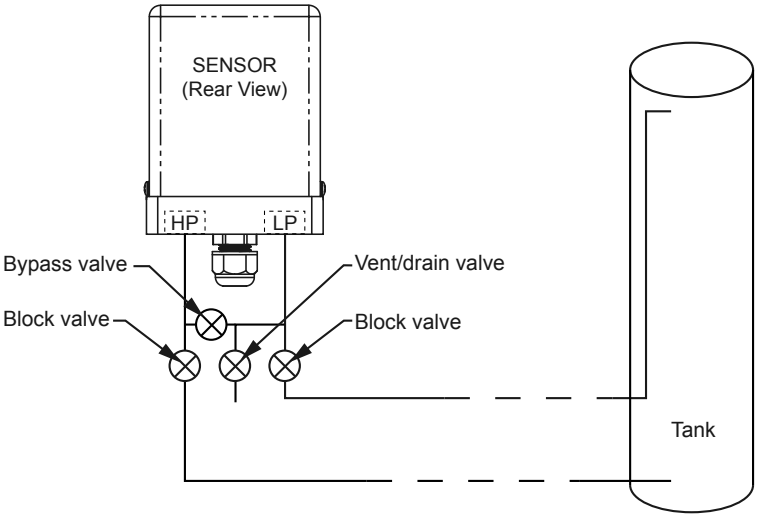


Figure 2.7—Sensor manifold arrangement

Important	The high pressure and low pressure ports are marked on the bottom of the sensor with an "H" and an "L" (Figure 2.8, page 19). Take note of these markings when installing piping to make sure that the high-pressure line is connected to the high pressure port and vice versa.

Figure 2.8—Sensor high pressure (H) and low pressure (L) markings

Section 3—Electrical Wiring and Connections

The integral sensor supplied with the standard CS60 is prewired at the factory, and many of the communications settings will be set at the factory.

Typically, field wiring consists of inserting a SIM card or connecting a phone line for communications, connecting the integral battery, and connecting a solar panel or AC power cable. Note that the terminal blocks are situated in a vertical row at the right side of the board for easy access. Wiring instructions and diagrams for these connections are supplied in this section.

If an optional I/O board is supplied with the CS60 (as shown in Figure 3.1), see Appendix A for I/O wiring instructions.

IMPORTANT AC-POWERED UNITS. Before the AC line voltage is wired to the unit, install a switch or circuit breaker at the AC power source as close as possible to the installed unit so the power can be turned off for service or maintenance of the unit.

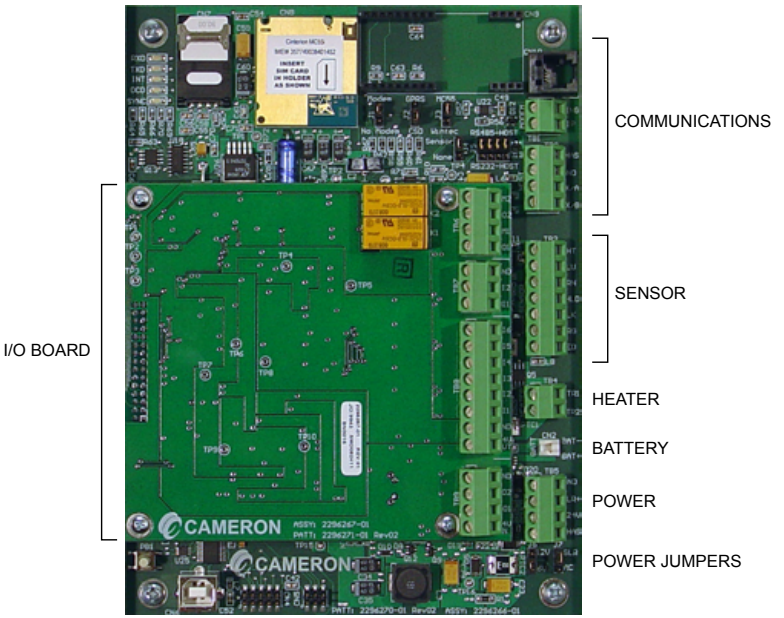


Figure 3.1—CS60 terminal connections

Jumpers and Connectors

In addition to terminal block wiring, there are a few jumpers that must be properly configured. Figure 3.2 calls out the locations of these jumpers and other connectors referenced in the wiring instructions on the following pages.

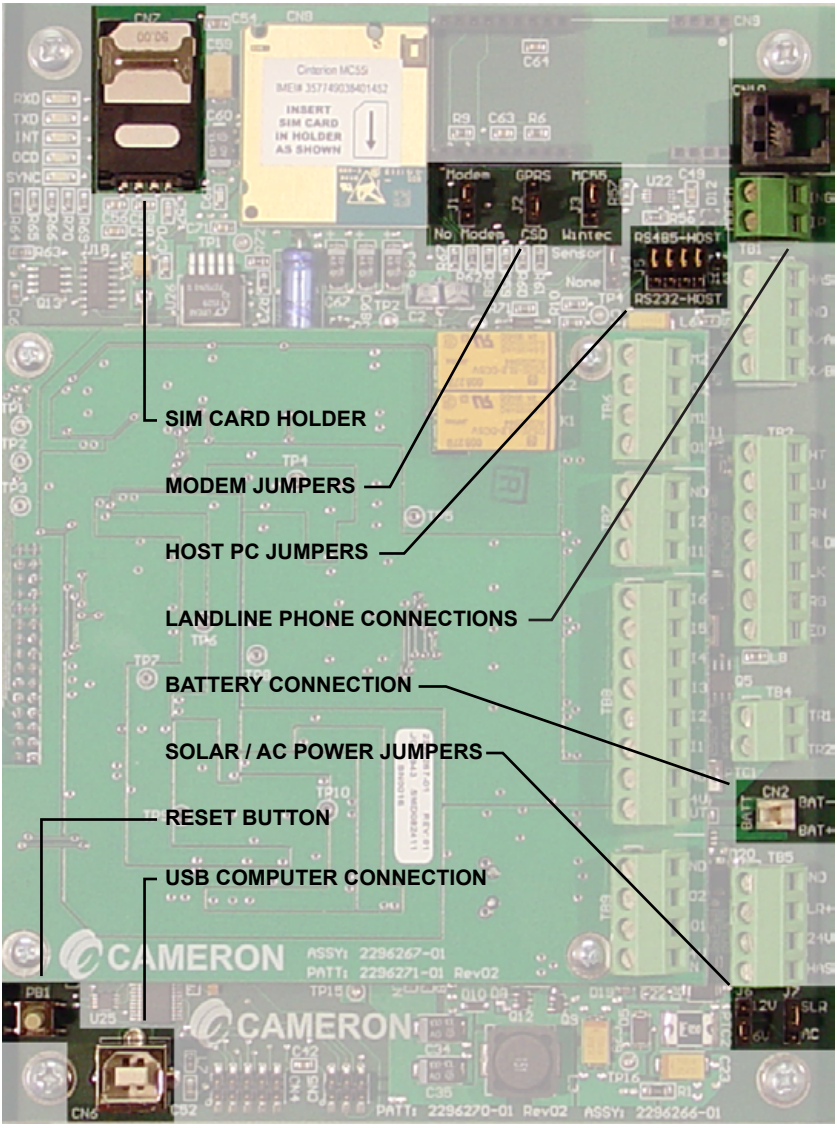


Figure 3.2—Locations of jumpers and communications connections

USB Computer Connection for RTU Configuration

The CS60 may be configured with CryoScan® PC software before or after installation, using either the direct (USB) or remote (modem) connection. Configuration requires the use of the full version of CryoScan® PC; the lite version supports read-only access.

To establish a direct connection with the RTU, connect a universal USB cable to the PC or laptop containing the CryoScan® PC software and to the USB connector in the lower left corner of the main board (Figure 3.2, page 22).

Connection for External Communication Devices

The CS60 is monitored remotely via a landline (telephone) or wireless (CSD or GPRS) modem. Alternately, external communication devices (radio, ethernet, etc.) may be connected to the host computer connections shown in Figure 3.3. Wire the external device to terminal block TB2 on the main board, and ensure that the RS-485/RS-232 host jumper is set to the appropriate setting.

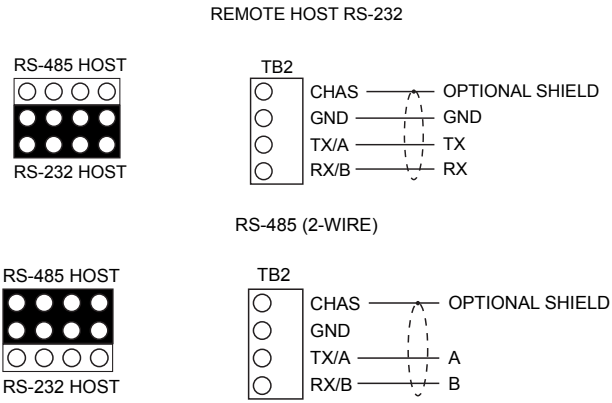


Figure 3.3—Host computer connections

NOTE: Remote host installations using RS-232 or RS-485 communications support inbound polling only. Contact the factory if your remote host application requires outbound connections from CS60.

Sensor Wiring

Sensor input is transmitted to the CS60 board via a small sensor board mounted inside the sensor manifold cover. When an integral sensor is purchased as part of the CS60, the sensor is pre-wired at the factory and the sensor jumper J4 on the main circuit board is set to the "sensor" position. Before attempting to operate the CS60, make sure the J4 jumper is correctly positioned. Should the jumper be set to "no sensor," the CS60 will not be able to read data collected by the sensor.

Additional sensors may be purchased and up to four sensors can be connected to a CS60. See Appendix B for instructions on installing remote sensors.

Remote Communications via Landline Modem (AC-Powered Units Only)

IMPORTANT: If phone lines are exposed and elevated, an external lightning suppressor should be used. Contact the local phone company for details.

Connect the CS60 to a land line modem as follows:

1. Set jumper J1 on the main board to the modem setting, as shown in Figure 3.4.
2. Set jumper J3 to the Wintec setting, as shown.
3. Connect a land line phone cable to the CS60 board using either of the following methods:
   - If the land line cable is terminated by an RJ11 connector, plug the connector into the CN10 (RJ11) connector on the main board, as shown in Figure 3.4.
   - If the cable has no connector, connect the leads to terminal block TB1, as shown.

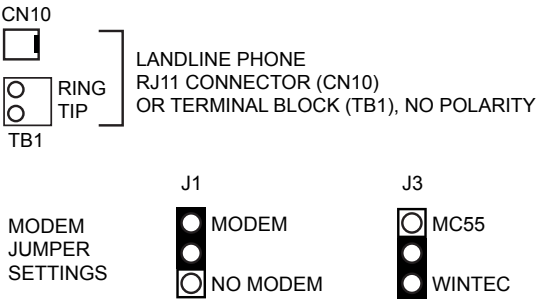


Figure 3.4—Land line modem settings

CAUTION For CE-compliant installations, the phone line must be connected to the CN10 (RJ11) socket on the main board. DO NOT use the TB1 connection.

Remote Communications via GSM Cellular Modem

IMPORTANT A SIM card and an appropriate GSM cell plan are required for a GSM modem-equipped CS60.

The CSD-type modem connects to the host computer with an analog landline telephone modem and requires a voice plan with the circuit switched dialed (CSD) option (to support the modem data transfer).

The GPRS-type modem connects to the host computer directly through the Internet, rather than through standard phone lines, and requires a SIM card and a wireless provider that supports GPRS communication and SMS messaging.

Cellular Mode Selection

1. Set jumper J1 on the main board to the modem setting, as shown in Figure 3.5.
2. Set jumper J2 to the desired mode—CSD or GPRS (GPRS is shown in Figure 3.5).
3. Set jumper J3 to MC55, as shown in Figure 3.5.

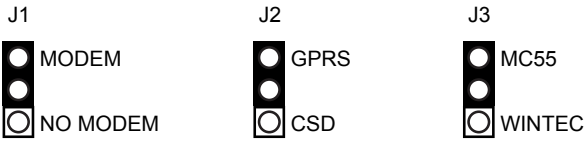


Figure 3.5—GSM modem settings

SIM Card Installation

CAUTION Make sure the SIM card is installed BEFORE powering the unit and always REMOVE POWER from the unit BEFORE removing the SIM card.

Install the SIM card as follows, referencing Figure 3.6, page 26, as necessary:

1. Locate the SIM holder near the top of the main circuit board. The SIM holder is a hinged frame held closed by a metal latch.
2. To open the holder, slide the metal latch down. The latch will release from the top and the front "door" of the frame will tilt open.
3. Insert the SIM card in the front "door" of the holder such that when the holder is closed, the corner of the card that is clipped diagonally is

positioned in the upper left corner and the SIM contacts face toward the board. A label on the GSM modem, installed next to the SIM card holder, also shows the correct SIM card position.

4. With the card fully inserted in the holder, close the "door" of the holder and slide the metal latch up to secure the latch in a closed position.

SLIDE METAL LATCH DOWN TO OPEN THE HOLDER

INSERT SIM CARD AS SHOWN (UPPER LEFT CORNER IS CLIPPED)

CONTACT SHOULD FACE TOWARD THE BOARD WHEN INSTALLED

CLOSE THE HOLDER AND SLIDE THE METAL LATCH UP TO LOCK IN PLACE

Figure 3.6—Slide latch SIM installation

If the SIM Slot is not a slide-latch type, contact Cameron's Measurement Systems Division for SIM installation instructions.

Connecting the Battery

The integral battery pack is shipped disconnected. To connect, simply attach the white plastic connector to the CN2 battery cable receptacle on the main board (Figure 3.7). This plug is "keyed" to ensure proper orientation.

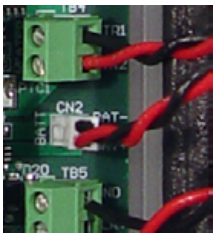


Figure 3.7—Battery connection (CN2)

For AC-powered units, the battery provides backup power if AC power is lost.

Connecting Solar Power

CAUTION	SOLAR POWER USERS. Make sure the battery is plugged in BEFORE connecting the solar panel and always disconnect the solar panel BEFORE disconnecting the battery. This sequence ensures the unit is properly started and shut down.

CAUTION	GSM MODEM USERS. Make sure the SIM card is installed BEFORE powering the unit (AC or Solar). Always REMOVE POWER from unit BEFORE removing the SIM card.

Connect solar power as follows:

1. Connect the solar panel cable to terminal block TB5 on the CS60 main board as shown in Figure 3.8.
2. Check the positions of the J6 and J7 jumpers. If the standard Cameron 12V solar panel is used, set the J6 jumper at 12V. If a customer-supplied 6V panel is used, set the J6 jumper in the 6V position.

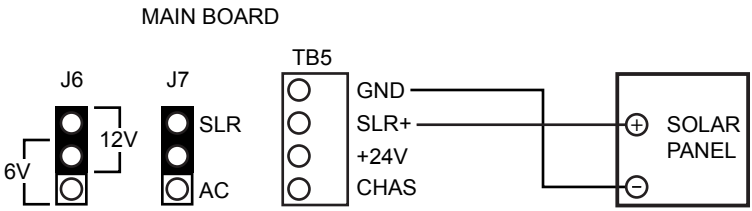


Figure 3.8—Solar cable connections to CS60 main board

3. Once power is applied, the unit will automatically begin a power-on test. The LCD will scroll through a progression of messages (see LCD Display Messages, page 29). If no errors are displayed, the unit is ready for operation.

Connecting AC Power

CAUTION	GSM MODEM USERS. Install the SIM card BEFORE powering the device (AC or Solar). Always REMOVE POWER from the device BEFORE removing the SIM card.

AC-powered units are equipped with a 100-240 VAC, 50-60 Hz power supply and a backup battery. Connect 24V external power as follows:

1. Set the J7 jumper to the AC position (Figure 3.9, page 28).

2. Check to ensure that the pre-installed wires from the power supply to terminal block TB5 are secure.
3. Attach the external power cable wires to the ground, neutral (N) and line (L) terminals of the power supply.

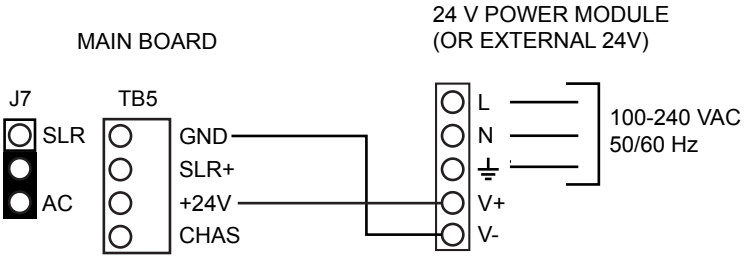


Figure 3.9—AC power connections to CS60 main board

4. Once power is applied, the unit will automatically begin a power-on test. The LCD will scroll through a progression of messages (see LCD Display Messages, page 29). If no errors are displayed, the unit is ready for operation.

Section 4—Operation

Initiating a Connection with the RTU (via Landline or CSD Modem)

Land line and CSD options establish connections between the host computer and the CS60 unit via two phone numbers. One number is used by the RTU when it calls "out" to the host computer and the other phone number is used by the host computer to call "into" the RTU.

Initiating a Connection with the RTU (via GPRS Modem)

If the CS60 unit communicates via GPRS, the SIM card installed in the CS60 must be capable of supporting GPRS communications. To successfully send a message via GPRS (from RTU to PC or from PC to RTU), the sending device must be able to recognize the receiving device by its IP address. Therefore, at least one of the devices (PC or RTU) must have a static (unchanging) IP address. Typically, the PC has the static IP address because this is more easily acquired than a static IP address for a GPRS-compliant SIM card.

In installations where the RTU SIM card does not have a static IP address, the host computer cannot call the CS60 directly; instead, it sends an SMS trigger message (text message) to the CS60 to initiate a connection. The CS60 then calls the host computer via the Internet. This is commonly called "mobile-originated" communications.

In installations where the RTU SIM card has a static IP address, the host computer can call the CS60 directly via the Internet without the aid of a trigger message. This is commonly called "mobile-terminated" communications. Contact the factory for details.

Communications are easily configured with CryoScan® PC software. A GPRS access point name (APN) and user name/password for the SIM card are required for configuring GPRS communications with a CS60 and must be obtained from the wireless carrier (user name/password may not be required).

LCD Display Messages

At power-on, the LCD will display a series of messages to indicate that the unit is booting properly. Among the indicators displayed are:

- modem detection
- power supply detection (AC type or solar type)
- bootloader version number
- application version number
- battery voltage
- sensor voltage or sensor firmware version

- solar panel voltage

If the unit is communicating via CSD, the display will show the following modem connection status after a slight delay:

- nStS (network status) - bottom display should contain a "1" or a "5"
- rSSI (cellular signal strength) - bottom display should read "9" or higher
- nodn ready (modem ready)

If the unit is communicating via GPRS, the display will show the same nStS and rSSI messages described for CSD, followed by these status displays:

- GPrS searching
- nStS (network status) - display should contain "1"s or "5"s
- GPrS ready
- nodn ready (modem ready)

Resetting the Unit

During normal operation, the user can reset the unit at any time to view unit status messages. Simply press the white reset button (PB1) and release. PB1 is located in the lower left corner of the main board (see Figure 3.2, page 22).

Pressing PB1 also activates modem status LEDs for approximately 2 minutes.

LCD Error Messages

Should the software fail to connect with the modem or the sensor, an error message will be displayed on the screen. See Table 4.1 for a description of some common error messages. If a connection problem cannot be resolved using the proposed remedies, contact Cameron technical support. Be prepared to provide the bootloader version number and application version number displayed on the LCD.

Table 4.1—LCD Error Messages (Land Line, CSD and GPRS Communications)

Message	Description	Possible Causes	Suggested Remedy
nSES (value in bottom display is zero)	Network is offline	If GSM modem in use, inadequate cellular service in the area	(1) Reposition the antenna to improve reception. (2) Check rSSI value. Value <9 indicates signal is too weak to power instrument.
modn FAIL	Modem failure	(1) Modem is damaged. (2) No connection to the network. (3) If GSM modem in use, inadequate cellular service in the area.	Check connections on modem board.
NodN SIn_ ProbLEn	SIM card problem	(1) Bad connection between the card and the modem board. (2) SIM card is damaged. (3) SIM card is missing.	Remove and inspect the SIM card for dirt, debris. If the error remains after reinserting the card, contact Technical Support.
SEnS FAIL	Sensor failure	(1) Sensor connection is loose. (2) Sensor is damaged.	Check the sensor connection to the main board. If the connection appears to be valid, contact Technical Support.
SoLr (value in bottom display is zero or near zero)	Problem with solar panel	Solar panel is not charging properly. (In full sun, value should be >500 mV for a 10W panel.)	Check solar panel connections.

Table 4.2—LCD Error Messages (GPRS Communications Only)

Message	Description	Possible Causes	Suggested Remedy
bAd APn	Problem with APN number (provided by wireless carrier); on bootup, "GPrS ready" will not be displayed.	Invalid or incorrect APN or User name/ Password.	Obtain proper APN information from wireless carrier and configure with CryoScan® PC program.

Modem Status LEDs

The modem status LEDs, located in the upper left corner of the main circuit board (Figure 4.1), are always enabled and visible in AC-powered units. In solar-powered units, the LEDs automatically turn off approximately 2 minutes after a reset/reboot to save power. To re-enable modem LEDs, press the white reset button (PB1) and release. The LEDs will remain visible for approximately 2 minutes. PB1 is located in the lower left corner of the main board (see Figure 3.2, page 22).

Figure 4.1—Modem status LEDs

GSM Modem LEDs:

RxD: Receive data

TxD: Transmit data

INT: Interrupt

DCD: Data carrier detect

SYNC: Cell site tower signal synchronization

After a reset/reboot, SYNC will blink on and off approximately once every second. The blinking will stop once the link is established with the cell site tower. RxD and TxD will blink simultaneously during data transmission.

Landline (Wintec SLM24xx) Modem LEDs:

RxD: Receive data

TxD: Transmit data

INT: Interrupt

DCD: Data carrier detect

RxD and TxD will blink simultaneously during data transmission. INT will turn on once a ring is detected and DCD will turn on once a connection is established. Both INT and DCD will turn off after a hang-up and modem reset.

Section 5—Maintenance

The CS60 is easy to install, easy to maintain, and expandable. The CS60 is capable of monitoring of up to four separate tank levels with the addition of external sensors.

Accessories

Table 5.1—CS60 Accessories

DESCRIPTION	PART NO.
Sensor— No Oxygen Cleaning	2296627-XX (contact factory for XX)
Sensor—Oxygen Cleaned	2296628-XX (contact factory for XX)
Sensor Remote Mount Kit (one per external sensor)	2350125-01
Bulk Sensor Cable, 100 ft	2296958-01
Bulk Sensor Cable, 500 ft	2296959-01
Antenna, External Directional, YAGI, 900 MHz GSM, Terminated SMA Male 50 Ohm (available in four cable lengths)	
Antenna with 5m Cable	9A-B5-001944
Antenna with 10m Cable	9A-B5-001945
Antenna with 15m Cable	9A-B5-002025
Antenna with 25m Cable	9A-B5-002026
Antenna, External Directional, YAGI, Multi-Band, US Frequency, 824-896 and 1870-1950 MHz, with 10-ft (3m) Cable	2350192-01
Antenna, External Directional, Multi-Band, Universal Frequency, 806-2170 MHz, with 5m Cable, SMA Male Connector and Integrated Mounting Bracket	2350055-01
External Antenna Adapter Kit (recommended for all external directional antennas)	2296954-01
Antenna Extender Cable, for Multi-Band US Frequency Antenna Only (available in three lengths)	
25-ft Cable	2296955-01
50-ft Cable	2296956-01
100-ft Cable	2296957-01
Heater	2350119-01

Additional Sensors

When ordering additional sensors, be sure to report to Cameron sales the number of existing sensors connected to the CS60. This will allow the factory to configure the sensor with the proper slave address so that fewer steps will be required to install the device in the field.

See Appendix B for installation instructions.

External Directional Antennas

CS60 cellular modem users in rural areas may require a directional antenna (Figure 5.1) for dependable communication. Table 5.1, page 33, lists a variety of antennas available from Cameron, including two multi-band antennas. While multi-band antennas are designed to work with a range of cellular frequencies, no single antenna will perform optimally in all locations. Contact your regional sales representative for assistance with antenna selection. A variety of antenna cable lengths are also available.

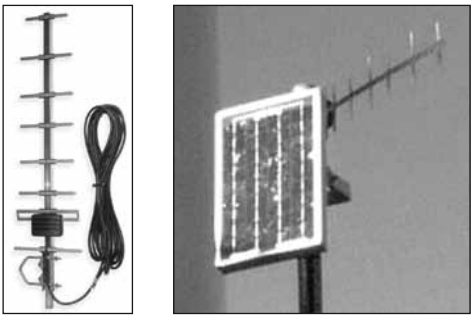


Figure 5.1—External directional antenna with cable

External Antenna Adapter Kit

Cameron has assembled an external antenna adapter kit to simplify the installation process. The kit includes a small adapter board, a 1/2-in. NPT gland seal, gland nut, and gland washer, a screw, and an SMA-TNCF adapter. The adapter may not be required if the external antenna being used has an SMA connector already attached.

To install the adapter kit,

1. Remove the components from shipping packaging.
2. Position the board so that the drilled hole in the board aligns with the hole molded into the upper left corner of the enclosure and secure with the screw.
3. Disconnect the small gray cable from the interior antenna and connect it to the connector on the adapter board, as shown in Figure 5.2, page 35. The other end of the cable is connected to the GSM modem module on the main board.
4. Route the external antenna cable through the bottom of the enclosure using the gland seal, nut and washer.
5. Connect the external antenna cable to the adapter board as shown in Figure 5.2 using the SMA-TNCF or other connector adapter if required. The adapter board has an SMA female connector and requires an external

antenna with either an SMA male connector, or a proper adapter to provide the SMA male connector.

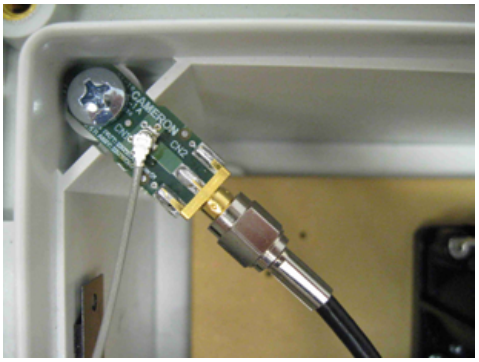


Figure 5.2—External antenna adapter kit

Spare Parts

Table 5.2—CS60 Spare Parts

DESCRIPTION	PART NO.
Solar Panel Sub-Assembly:	
Remote 10W Solar Panel with 9 ft of cable	2296931-01
Remote 10W Solar Panel with 35 ft of cable	2350049-01
Solar Panel Mounting Bracket	9A-99006000
Battery	9A-0130-1050T
Battery Cable	2296945-01
Power Supply	2296930-01
Power Supply Cable	2296944-01
Sensor, Replacement	Order the part number on the sensor tag.
	For new sensors, see Table 5.1.
Sensor Cable Assembly for Integral Sensor	2296948-01
	For remote sensor cables, see Table 5.1.
Main Board	2296266-01
I/O Board	2296267-01
Communications Module:	
Landline Modem Module (AC-powered units only)	9A-0176-1857T
Quad-Band Cellular Modem Module GSM (GPRS/CSD)	9A-0176-1874T
Internal Antenna (GSM Modem Only)	9A-CS50-1055T
Notes: 1. When ordering parts, please specify the serial number of the instrument. 2. The parts list is subject to change. Consult Cameron for current information.	

Sensor Replacement

To order a replacement sensor, it is important to reference the tag attached to the top of the sensor manifold cover (Figure 5.3). The part number on the tag identifies specific attributes of the sensor being replaced (such as whether it is oxygen cleaned and what slave address is assigned to it). This information will ensure that the replacement sensor will come preconfigured for immediate replacement.

See Appendix B for installation instructions.

Figure 5.3—Sensor tag affixed to the top of the sensor cover

Section 6—Compliance/Approval Statements

General

For CS60 compliance and approval information, other certifications, approval-specific installation and use instructions (if required), warranty service, or repair, contact Cameron's Measurement Systems Division:

Cameron
Measurement Systems Division
14450 JFK Blvd.
Houston, TX
Phone: 1-800-654-3760

CE Compliance

This product has been tested and confirmed to be in compliance with all EU directives (in effect at the time of testing) for heavy industry use. There may be a temporary degradation of performance at extreme levels of electromagnetic interference.

This instrument complies with the Electromagnetic Compatibility Directive 2004/108/EC and the Low Voltage Directive 2006/95/EC.

For more information, contact Cameron's Measurement Systems Division.

Landline Modem Option (AC-Powered Units Only)

OEM - Wintec SLM24xx Modem Statement:

Wintec's SLM24xx modem has been tested and passed major homologations for global applications: (a) FCC Part 68, (b) FCC Part 15, (c) IC-CS03, (d) CTR21, (e) CE marking, and (f) UL certification.

CTR21 is a consortium of 21 countries that have developed a common PTT (Post Telegraph & Telephone) modem specifications. CTR21 includes the following countries: Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Liechtenstein, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.

FCC includes the following countries: Caribbean, Central America, China, Hong Kong, Malaysia, Mexico, Saudi Arabia, South American, Taiwan, United Arab Emirates, and the United States.

For more information, contact Cameron's Measurement Systems Division.

GSM Cellular Modem Option

OEM - Cintereon GSM Cellular Modem Statement:

The FCC Equipment Authorization Certification for the MC55/MC56 reference application is listed under the FCC identifier QIPMC55/QIPMC56, granted to Cintereon.

The MC55/MC56 reference application registered under the above identifier is certified to be in accordance with the following Rules and Regulations of the Federal Communications Commission (FCC). "This device is to be used only for mobile and fixed applications. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter."

This device is approved as a module to be installed in other devices.

For more information, contact Cameron's Measurement Systems Division.

A-Tick Compliance

A-Tick indicates compliance with Australian telecommunications requirements and enables approved equipment to be legally connected to the Australian Telecommunications Network. A-Tick compliance is also required in New Zealand.

C-Tick Compliance

C-Tick indicates compliance with Australian electromagnetic compatibility requirements and radiocommunications standards. It signifies that the product may be legally sold in Australia. C-Tick compliance is also required in New Zealand.

Appendix A—Input/Output Connections

An optional I/O board for the CS60 supports up to six analog inputs, two contact closure inputs for use with a pressure switch, two 4-20 mA outputs, and two latching relay outputs. Figure A.1 shows the location of the I/O board with respect to the main board and the arrangement of I/O terminal blocks.

Individual wiring diagrams for each input/output are also provided in this appendix.

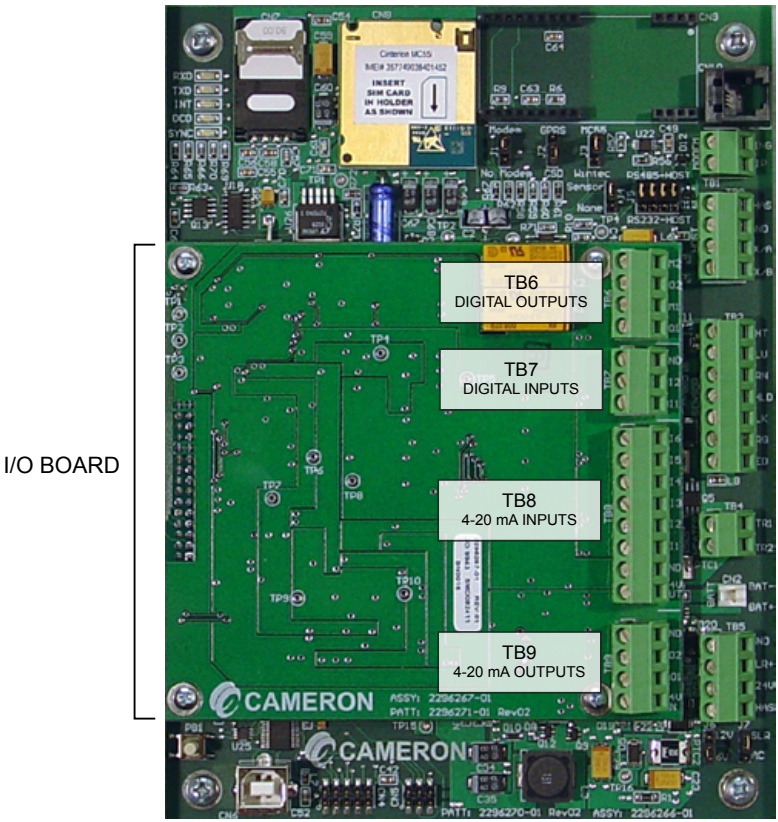


Figure A.1—Optional I/O board

Installing an I/O Board

If an I/O board is ordered with the CS60 RTU, it will be pre-installed at the factory prior to shipment. See field wiring instructions on pages A-3 through A-5.

If the I/O board is ordered separately, install the I/O board as follows:

1. Remove the I/O board from its packaging. Four screws and four nylon standoffs should be included with the board.
2. Locate the four standoffs on the main board used to support the I/O board.
3. From the terminal strip side of the board, insert a screw through each corner screw hole.
4. Press a nylon spacer onto the screw heads so the "tang" or "retaining" side of the spacer contacts the board (Figure A.2).
5. Carefully place the I/O board over the standoffs, so that the terminal blocks are vertically aligned on the right and the Cameron logo is facing upward. Make sure the CN1 receptacle aligns with the CN1 connector on the main board; then press the receptacle into the connector to secure the two boards together.
6. Position the board over the standoffs and the CN1 connector and tighten the corner screws to secure.

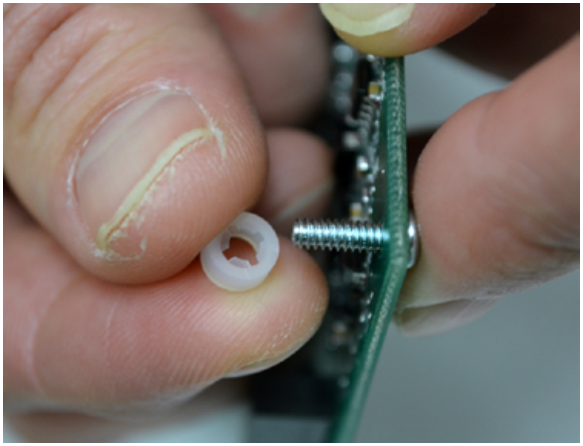


Figure A.2—Orientation of retaining spacer for I/O board

Analog Inputs

When an I/O board is installed, 4-20 mA transmitters can be used for level pressure, temperature and other inputs. The I/O board supports analog inputs from externally powered 2-wire transmitters as well as transmitters powered by the RTU. See wiring diagrams in Figure A.3. The CS60 I/O board supports up to six analog inputs.

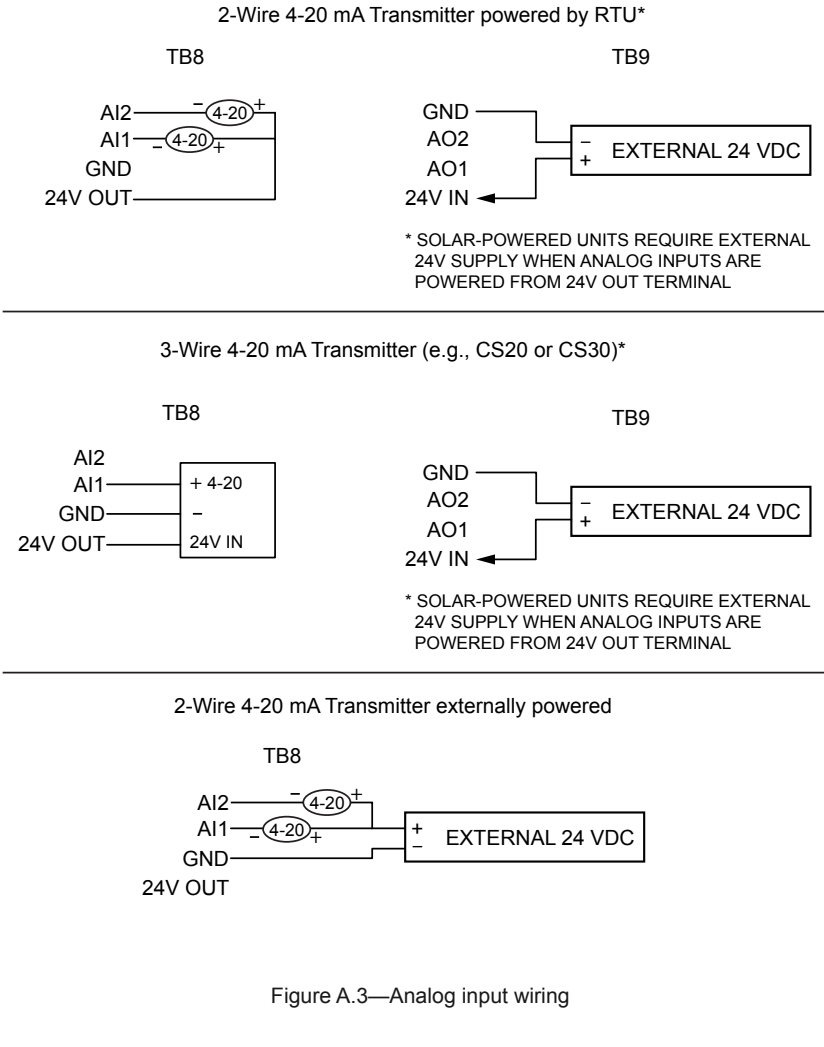


Figure A.3—Analog input wiring

Digital Inputs

The CS60 I/O board supports two digital inputs. Either can be connected to a dry contact switch or a voltage output device.

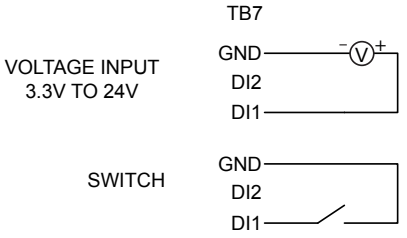


Figure A.4—Digital input wiring

Analog Outputs

The CS60 I/O board supports two analog outputs for use with an analog display or as an input to another system.

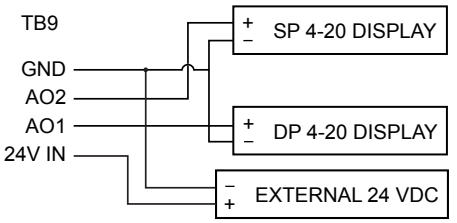


Figure A.5—Analog output wiring

Digital Outputs

The CS60 I/O board supports two latching relay outputs for use in driving an alarm indicator or annunciator or to activate a pump, motor control, or other device from an alarm condition or manual control via a host computer. The CS60 can be configured to activate a relay output on any combination of measurement alarms.

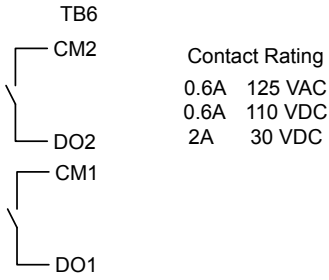


Figure A.6—Digital output wiring

Appendix B—Sensor Wiring

Sensor input is transmitted to the CS60 board via a small sensor board mounted inside the sensor manifold cover. When an integral sensor is purchased as part of the CS60, the sensor is pre-wired at the factory (Figure B.1).

External sensors are shipped separately and must be field-wired. A remote mount kit contains all hardware required to mount an external sensor. A remote mount kit should be ordered for every external sensor to be installed.

Figure B.1—Integral sensor

Multiple Sensor Connections

Each CS60 will support up to four sensors. External sensors are installed, one per tank to be monitored, and are wired in series. External sensors may be installed with or without an integral sensor. If the CS60 has an integral sensor, external sensors are wired to the integral sensor board. If the CS60 does not have an integral sensor, the external sensor located nearest the device is wired directly to the main CS60 circuit board.

Each sensor has two conduit entries on the bottom of the manifold. A 1/4-in. NPT cord grip comes pre-installed in one opening, and a red plastic plug is pre-installed in the other.

Sensor Mounting Kit

A sensor mounting hardware kit and bulk cable is recommended for each remote sensor purchased. The kit contains a mounting plate, two screws, a U-bolt, two nuts and a 1/4-in. NPT cord grip (Figure B.2, page B-2).

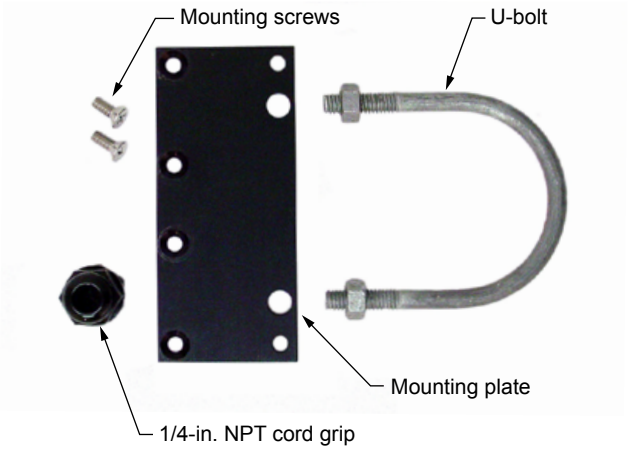


Figure B.2—Sensor mounting kit

Sensor Installation Procedure

Install multiple sensors as follows:

1. Disconnect power from the RTU (AC power supply or solar panel and battery connector).
2. Attach the remote sensor to the mounting bracket provided in the hardware kit using the screws provided. Position the countersink holes away from the sensor. If the bracket is to be pole-mounted, rotate the bracket so that the U-bolt hole pattern extends below the sensor manifold.
3. Mount the remote sensor as appropriate, using bolts or screws for a wall mount or using the U-bolt to install it on a 2-in. pole.
4. Remove the screws on either side of the integral sensor cover and lift off the cover to gain access to the sensor terminal block.
5. Remove the red plastic plug from the bottom of the integral sensor (as shown in Figure B.3, page B-3) and install the cord grip supplied in the sensor mounting hardware kit.
6. Cut the bulk cable to the appropriate length to span the distance between the integral sensor and the external sensor.
7. Install shielding on the bare ground wire or otherwise prevent the ground wire from contacting any circuitry or wires.
8. Route the cable through the unused cord grip of the integral sensor, and strip off the outer insulation to expose seven colored wires. Wire to the corresponding color-coded terminals (Figure B.4, page B-3). Since these terminals already contain wires from the cable that connects to the CS60 main board, this will result in two wires being inserted into each sensor terminal. Gently tug at each wire to ensure it is snugly connected.

9. Route the other end of the cable through the cord grip of the external sensor, and strip off the outer insulation to expose seven colored wires. Wire to the corresponding color-coded terminals.
10. Put the sensor cover back on the integral sensor and replace the two screws that were removed in step 4.
11. Repeat steps for any additional external sensors, connecting them in series in a daisy-chain configuration.

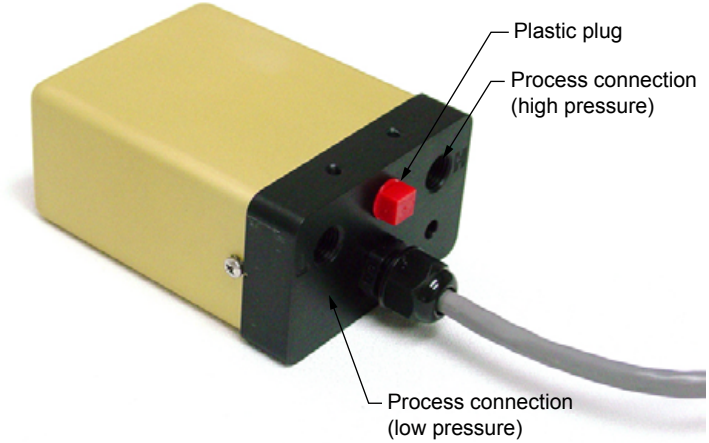


Figure B.3—CS60 sensor wiring and process connections

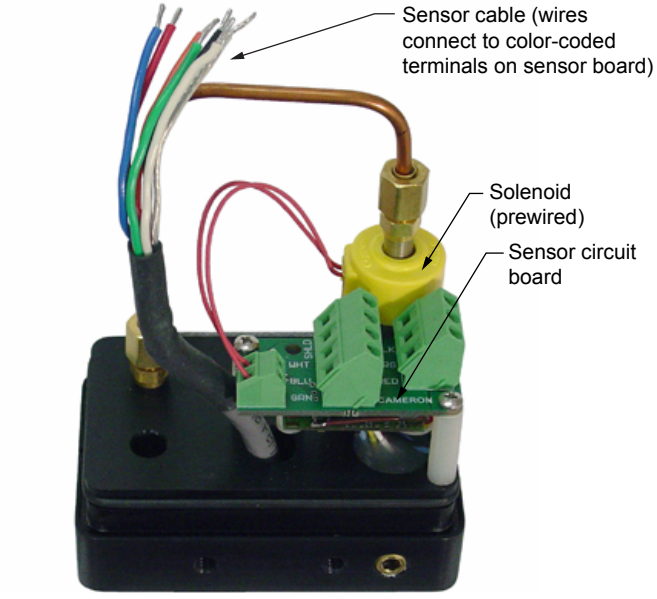


Figure B.4—CS60 sensor components

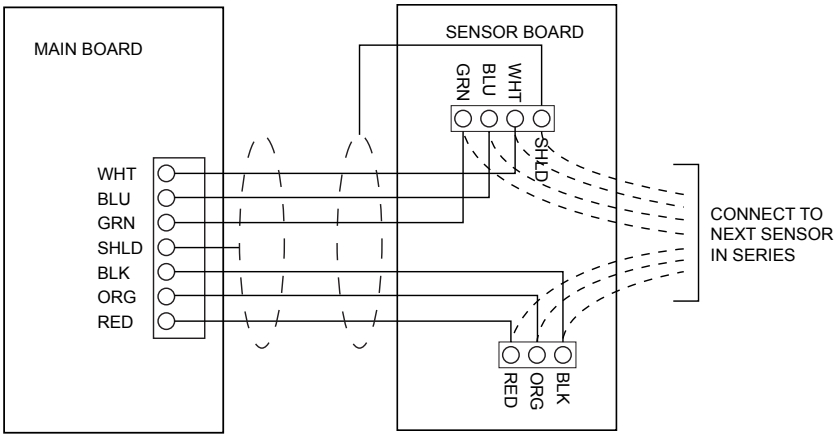


Figure B.5—Multi-sensor wiring diagram

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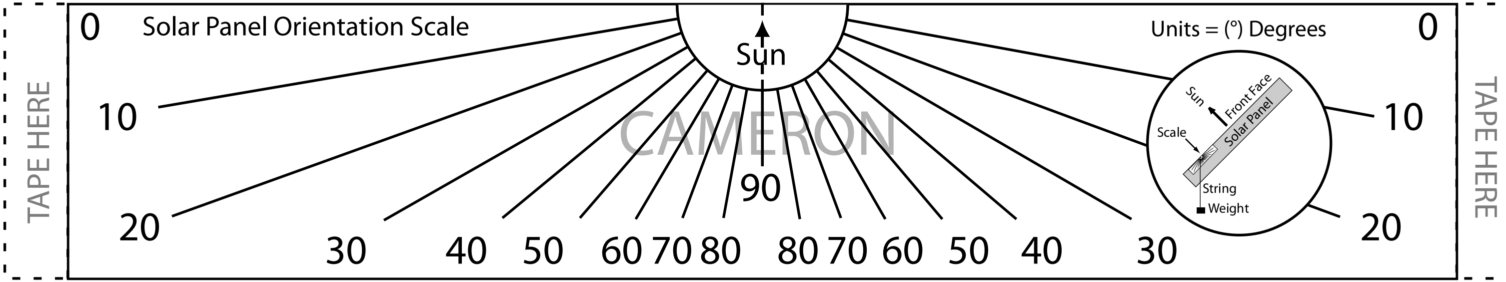
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Solar Panel Orientation Scale
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Solar Panel
Scale
String
Weight
CAMERON
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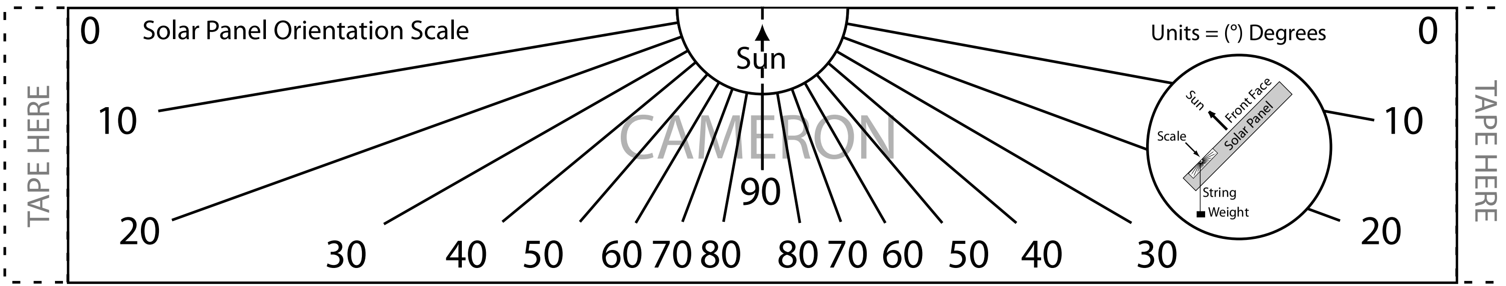
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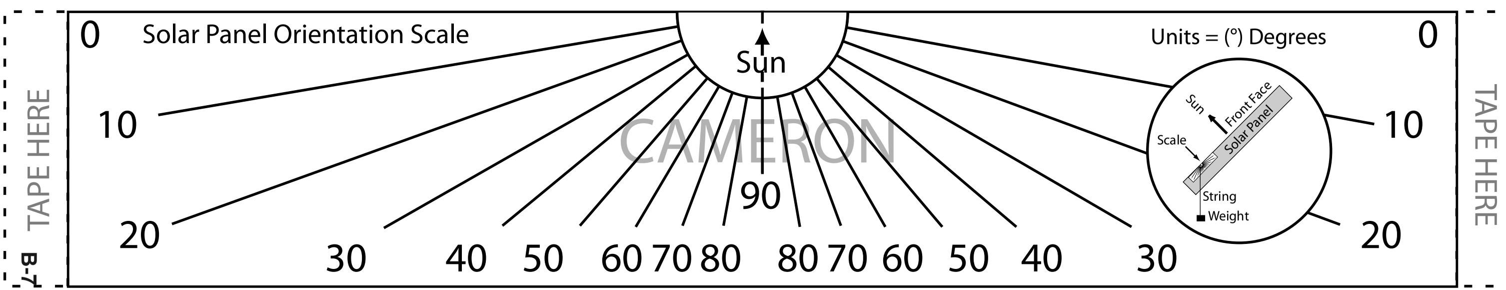
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Units = (°) Degrees
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Front Face
Solar Panel
Scale
String
Weight
CAMERON
TAPE HERE

MEASUREMENT SYSTEMS

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