

NUFLO™

Scanner 1141 RTU Hardware User Manual



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A limited warranty applies to products manufactured by Cameron's Measurement Systems Division. The Company will assume responsibilities for obligations, related to its products, which are specifically noted within the written warranty for a specific product. However, the Company will not be liable for any loss, damage, cost of repairs, incidental or consequential damages of any kind,

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Any use or application that deviates from the stated performance specification is not recommended and could render the instrument unsafe.

The Company should be advised of any apparent deviation or deficiency from specifications including safety-related deficiencies. A return authorization will be issued where applicable for goods returned for inspection, calibration or repair, under warranty.

Product Warranty Statement

The warranty applicable to this product is stated at the beginning of this manual.

Should any problem arise after delivery, contact Cameron's Measurement Systems Division **HelpDesk** at **1-877-805-7226** or the **Customer Service** department during normal business hours at **(403) 291-4814**.

Before installing the instrument, carefully read the installation instructions in this manual.

Also, be aware of the following important notices that appear throughout the manual:



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



CAUTION notes indicate the presence of a hazard that, if ignored, will or can cause minor personal injury or property damage.

Please be aware that the above notices appear on the following pages:
15, 20, 25, 42, 55, 57, 58 and 63

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Chapter 1: Overview and Specifications

Overview of the Scanner[®] 1141

The Scanner[®] 1141 is an economical, single-stream or dual-stream measurement Remote Terminal Unit (RTU) with flow and pressure control capability. It offers a powerful alternative to chart recorders in gathering data for natural gas production and includes a full range of operator-selectable mass, energy, and volume algorithms. The Scanner 1141 is Class I, Div. 2 certified by CSA (US and Canada) for use in hazardous areas.

A serial MVT (multi-variable transducer) mounts directly to the Scanner 1141 to provide accurate, low-cost measurement of static pressure, differential pressure, and temperature in a single device. The MVT is connected to the Scanner 1141 with an interconnect board that also provides an RTD input.

The 1141 also accepts static pressure, differential pressure, and temperature inputs from the NuFlo MVX[®]-II multi-variable transmitter, as well as inputs from low-power (1-5 VDC) and 4-20 mA transmitters, RTDs, and pulse-producing devices such as the NuFlo and Barton turbine meters.

The Scanner 1141 stores up to 60 days of flow history in nonvolatile memory with an audit trail of all events, alarms, and user changes. A separate replaceable lithium backup battery secures this information against power failures. Stored data can be downloaded on-site or communicated to a central location.

An integral rechargeable battery module uses a solar panel and contains a temperature-compensated charge controller and a 6V or 12V air-transportable, sealed lead acid (SLA) battery.

See [Battery Charge Indicator](#), page 89, for a description of the four basic states or stages of battery charging.

The Scanner 1141 provides battery/power voltage for powering transmitters and communication devices. A 12Vdc supply for powering transmitters and a 5-VDC, 200-mA supply is optionally available for low-power radios. The Scanner 1141 communicates with local gas chromatographs, and supports ScanCom and Modbus. Other custom protocols may also be supported. For remote communications, the Scanner 1141 supports radio, modem, phone, and satellite access. An optional lightning arrestor is also available. Currently, remote communication devices and lightning arrestors require CSA special acceptance.

The power management system ensures that the Scanner 1141 consumes minimum power while collecting and processing data.

Standard communications and status/pulse inputs are easily expanded.

The following features in the Scanner 1141 provide convenient and flexible operation:

Configurable Memory - A full set of menu-selectable calculation options are stored in Flash memory in each Scanner 1141. As new industry standards are adopted, new programs are easily loaded from a PC with WinsLoad or ScanFLASH Utility software (See [Appendix E: Flashing the Scanner](#), page 113).

Security - Five security levels and selectable display options provide easy access to core functions while maintaining full protection of configuration and flow history.

Power Supplies - Choose from line power or various battery configurations with thermoelectric or solar charging options to minimize installation costs and meet site and hazardous area safety requirements.

Sampling Frequency - Select end-device sampling rates that optimize the Scanner 1141's ability to simultaneously measure/control flow and pressure while conserving power.

Calibration - A variety of methods are available for linearizing end devices to maintain the highest accuracy. A detailed record of calibration information is stored automatically in the Scanner user change log and can be used to monitor and diagnose transmitter performance.

Controls – Two types of controllers are available: (1) a basic proportional/integral controller and (2) an IEC 61131 programmable controller called ScanPLC. Various control options are easily configured using simple menus with input/output selections for both throttling and ON/OFF control. Four status input/outputs and an analog output make the Scanner 1141 ideal for:

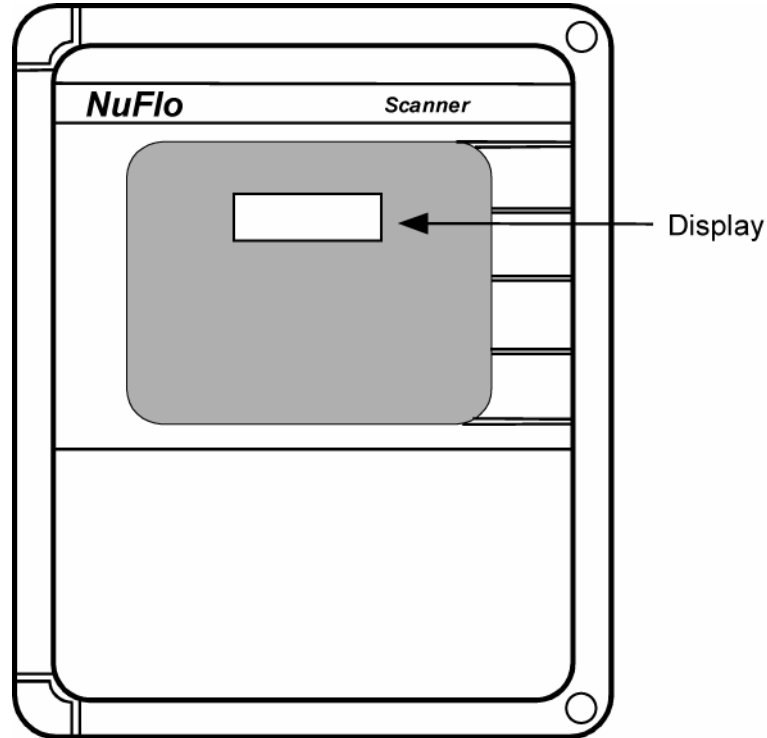
- proportional integral control
- emergency shutdown
- run switching
- programmable logic status
- well optimization

Enclosures

The Scanner is available in three enclosure designs:

- 1141C— NEMA 4 or optional 4X, fiberglass-reinforced plastic, 14 1/2 in. wide x 16 1/2 in. high x 8 1/3 in. deep (shown on the manual cover, left)
- 1141L—NEMA 3, painted steel, 12 in. wide x 12 in. high x 8 in. deep (shown on the manual cover, right)
- 1141G—Chassis for mounting in an enclosure or panel (ideal for integrators and engineering/construction firms), 9.6 in. wide x 10.1 in. high x 2.5 in. deep

Standard Display



The standard display on the Scanner 1141 is a large 2-line \times 16-character liquid crystal display (LCD) with optional backlighting.

To save power, the display can be configured to shut off automatically after a user-specified time period (usually about 30 seconds). For the backlight option, an LCD PwrSav jumper can be configured to turn off both the display and the backlight (jumper is in the ON position), or to turn off only the backlight (jumper is in the OFF position) when the Display Timeout is reached.

The Scanner 1141 is equipped with a button that is pressed to “wake-up” the display (Figure 1.1).



Figure 1.1—Display “wake-up” button

Auto-scroll

The display “auto-scrolls” through a list of user-definable readouts. Each item is held on the display for a configurable amount of time and is then replaced by the next item in the list. An operator can pause the auto-scroll on any displayed item by pressing the “wake-up” button.

The following is a sample of an auto-scroll screen:

```
Run 1 Pf On
492.00000 PSI
```

While in auto-scroll, the following unit status screen is displayed each time the Scanner completes a loop through the list:

```
Time= 09:00 ML
Date= Jan 01/95
```

The display will shut off automatically after a configurable amount of time (usually about 30 seconds). To “wake-up” the display, press the “wake-up” button.

Scanner Software

ScanWin Lite is a Windows™-based software program for monitoring, configuring and downloading Scanner Measurement RTU data on-site. ScanWin Lite’s “wizards” guide the operator through the setup of hardware, flow runs, and primary devices as well as the collection of hardware, system, and flow run data. Reports can be exported and printed from ScanWin. ScanWin Lite also facilitates the upload and download of configuration settings.

ScanWin Pro, an optional upgrade from ScanWin Lite, combines all of the functionality of ScanWin Lite with a flow run catalog and a relational database that stores historical information for off-line review. ScanWin Pro also supports the configuration of advanced control and data capture functions and various connection methods for remote communication with the Scanner 1141.

Scanner Firmware

The Scanner 1141 supports current NGas, NFLo and IGas firmware. Gas calculations meet both North American (NGas/NFLo) and international measurement standards (IGas).

All three programs accept signals from orifice or turbine meter inputs and RTD temperature inputs. Gas composition values can be automatically updated through a gas chromatograph interface using the RS-232 communications port, or they can be manually entered.

All calculations are performed in SI metric units. The Unit Manager automatically converts other units as required.

IGas

The international standard (IGas) includes ISO-5167, which supports a variety of differential pressure meters, venturi and flow nozzles. ISO-T30SC1088 is supported for turbine meter measurement.

NGas

NGas firmware solves Manual of Petroleum Measurement Standards (MPMS), and American Gas Association (AGA) (Reports 3 (1992), 5, and 7) calculations including volume, mass, and energy. The calculation speeds meet or exceed API standards for flow computers. The supercompressibility calculations performed include:

- AGA-8 (1992)
- Redlich-Kwong
- Standing Katz

- An interpolation method
- GERG Virial Equation for Field Use
- Standard GERG Virial Equation

NFlo

NFlo performs the same calculations as NGas, plus liquid properties calculations based on the API Manual of Petroleum Measurement Standards (MPMS) chapters 11.2.1, 11.2.2, 11.2.3 and API 2540.

Audit Trail

The Scanner 1141 maintains a detailed audit history of all configuration records, user changes and system alarms. It also maintains a history of events including hourly and daily flow history. The Event log operates as a circular buffer that contains 100 typical events. Each new event added to the log causes the oldest event to be discarded. If the User Change log is full, it will not accept any further changes or inputs until the user downloads the log. This feature ensures that the audit trail is continuous. Up to 60 days of history records can be maintained in nonvolatile memory.

Chapter 2: Installation



CAUTION

CAUTION

ALWAYS TURN OFF POWER TO THE SCANNER 1141 BEFORE REMOVING ANY ELECTRONIC CIRCUIT BOARDS. FAILURE TO DO SO CAN DAMAGE THE SCANNER. CIRCUIT BOARDS ARE SUBJECT TO DAMAGE IF EXPOSED TO STATIC ELECTRICITY.

CIRCUIT BOARDS MUST BE HANDLED AND INSTALLED IN AN ENVIRONMENT FREE OF STATIC ELECTRICITY AND THE OPERATOR MUST BE GROUNDED.

WHEN REMOVING CIRCUIT BOARDS FROM THE SCANNER 1141, ALWAYS PLACE THEM IN PROTECTIVE CONDUCTIVE ENVELOPES.

NEVER SUBJECT THE RTU TO AMBIENT OR OPERATING TEMPERATURES BEYOND -40°C to +60°C (-40°F to +140°F). FOR ADDITIONAL INSTRUMENT SPECIFICATIONS, SEE APPENDIX A.

Note: Circuit boards returned to Cameron's Measurement Systems Division factory for repair must be properly packed for static protection. If they are not, the boards will not be covered by the Cameron warranty.



WARNING

WARNING—EXPLOSION HAZARD

ENSURE THAT THE AREA IS NON-HAZARDOUS BEFORE CONNECTING A PC TO A SERIAL PORT, OPENING THE ENCLOSURE OR ADDING OR REMOVING ANY WIRES.

FOR CLASS I, DIVISION 2 INSTALLATIONS, ACCESS TO THE INSIDE OF THE ENCLOSURE MUST REQUIRE A TOOL. ACCEPTABLE LOCKING DEVICES ARE TIE-WRAP, SEAL WIRE, A LOCK OR A NUT AND BOLT.

Securing the Enclosure

Figures 2.1 through 2.4 show examples of materials that are appropriate for securing the 1141 enclosure for Class I, Division 2 installations so that a tool is required to gain access. A lock may also be used to secure the enclosure.

The seal wire, shown in Figures 2.3 and 2.4, must be used for custody transfer applications where government regulation agencies such as Measurement Canada require the seal.



Figure 2.1—1141L with a tie-wrap fastener



Figure 2.2—1141C with a nut and bolt fastener



Figure 2.3—Seal wire installation on an 1141C latch (left) and an 1141L latch (right)



Figure 2.4—Seal wire installation on an 1141C hinge (left) and an 1141L hinge (right)

The following chart outlines the sequence of steps required for installing the Scanner 1141 RTU:

Table 2.1—Installation Summary

Step	Description	Reference Section
1	Unpacking the Scanner	Page 18
2	Mounting the Scanner	Page 199
3	Connecting the Scanner to piping	Page 20
4	Connecting the power supply and charge controller	Page 23

Unpacking the Scanner

The Scanner 1141 is carefully inspected during manufacturing and before shipment. However, to ensure that no damage occurred during shipment, inspect the equipment as you unpack it. The following items should be included with each shipment:

- Scanner 1141, completely assembled (Figures 2.5 and 2.6)
- Battery (optional)
- RTD (optional)
- Solar panel (optional)
- ScanWin Lite software CD

To remotely configure or collect data from the Scanner 1141, an IBM-compatible PC with Microsoft Windows operating system and ScanWin Lite (or ScanWin Pro) user interface software is required.

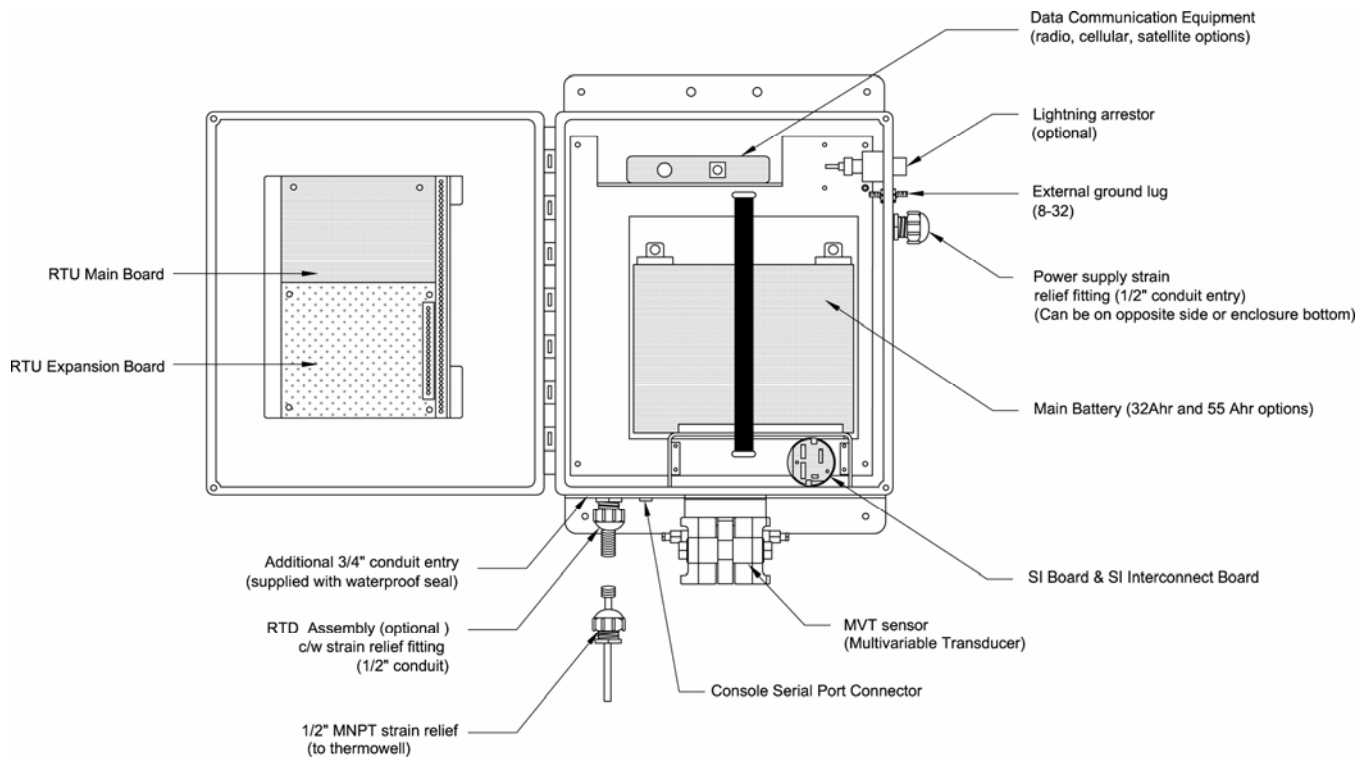


Figure 2.5—Components of 1141C

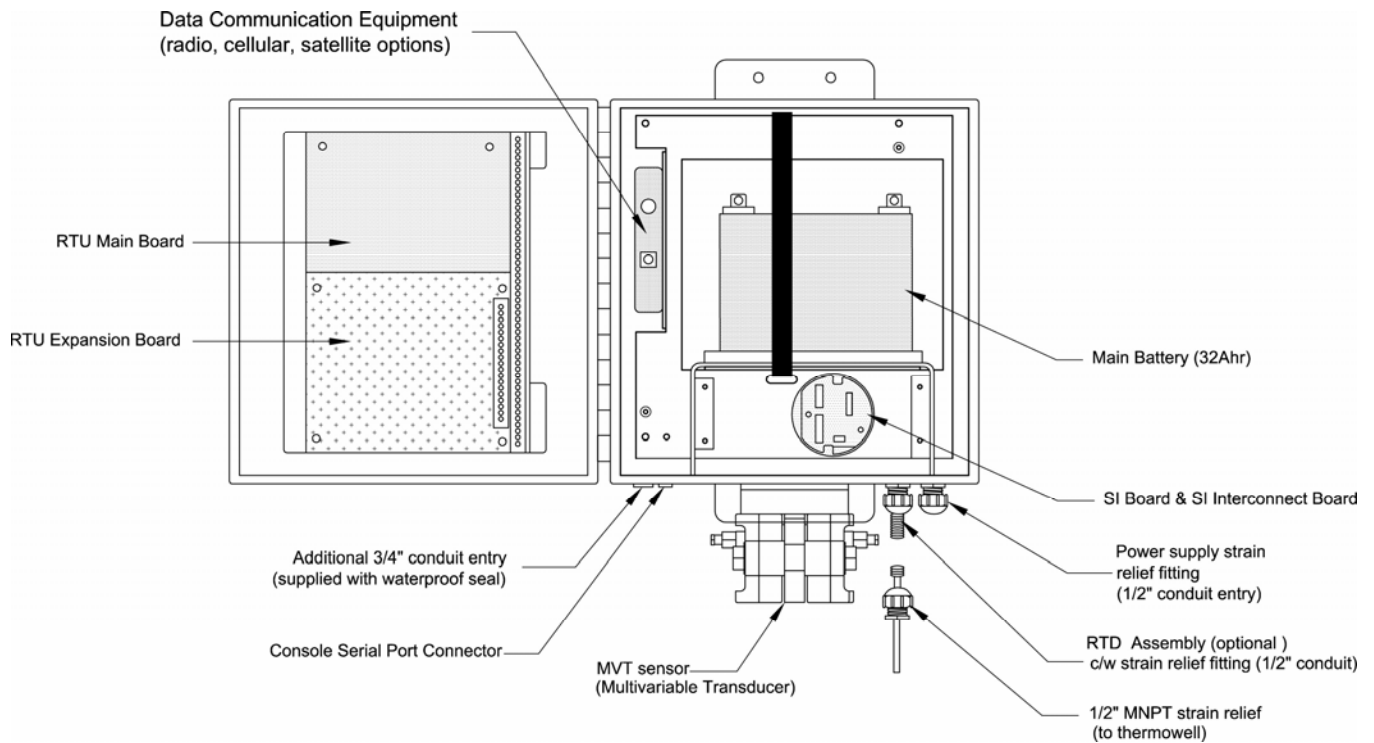


Figure 2.6—Components of 1141L



CAUTION

CAUTION

MOUNT BATTERY TERMINALS TOWARD THE FRONT OF THE ENCLOSURE TO HELP PREVENT THE TERMINALS FROM CONTACTING THE INTERNAL METAL BRACKETS.

Mounting the Scanner

A universal 2-in. bracket is used to mount the Scanner 1141C and 1141L to a wall or a pipe. The 1141G is surface-mounted using the four holes on the mounting plate. See [Outline Dimensions, page 91](#) for size and location of brackets.

Connecting the Scanner to Piping

All piping connections are made in accordance with standard practices. For orifice meters, consult API Chapter 14.3, Part 2 or AGA-3, Part 2 (1991) for more information. For turbine meters, consult API Chapter 5.3 or AGA-7.

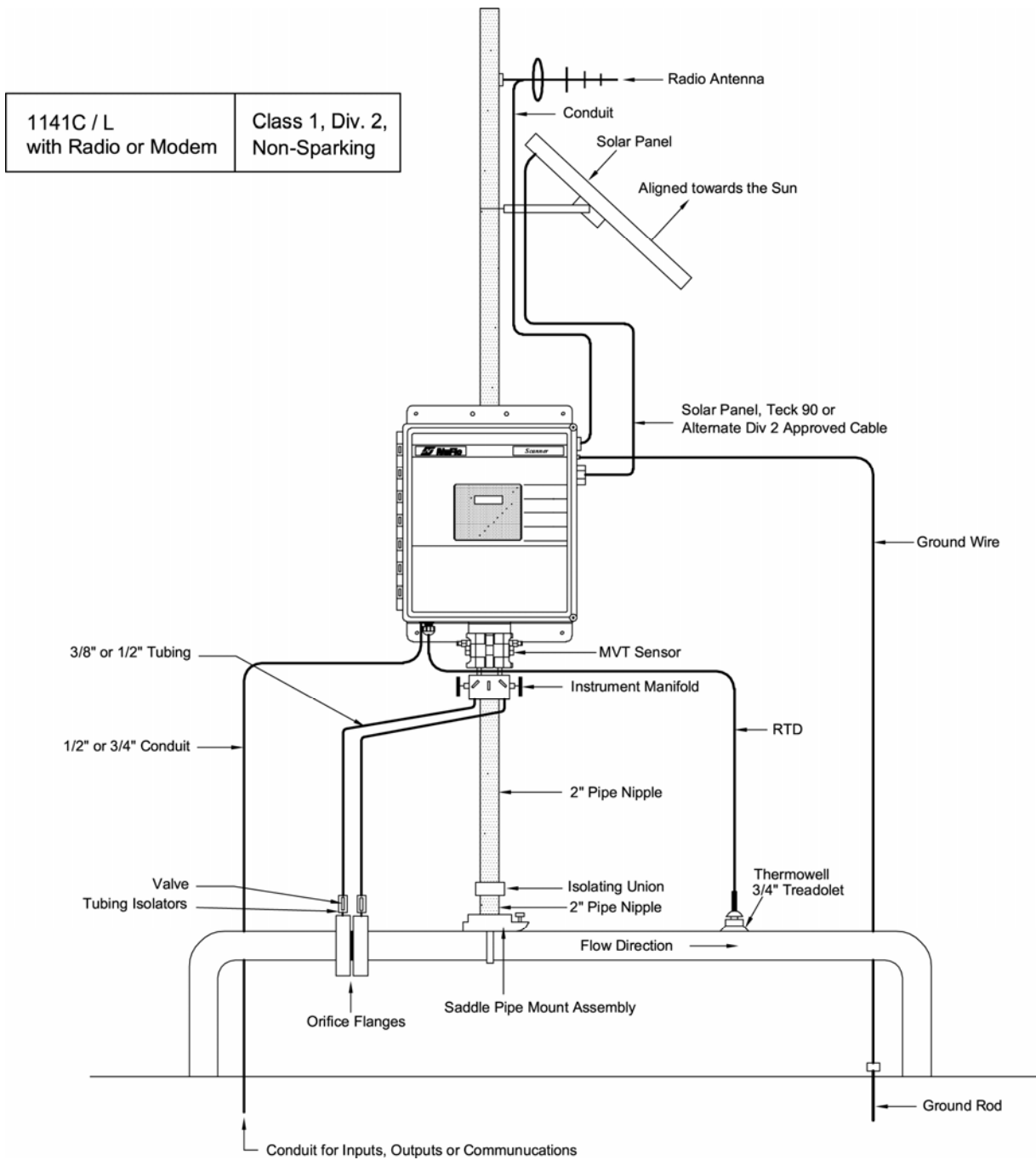


Figure 2.7—Typical installation of Scanner 1141C/L with a radio or modem for Class 1, Div. 2 installations (integral communications)

Note: Solar panels must be installed in accordance with Div. 2 wiring methods, using TECK cable or conduit. See control drawing 2 on page 97.

The radio antenna must be installed per Div. 2 wiring methods. See control drawing 3 on page 98.

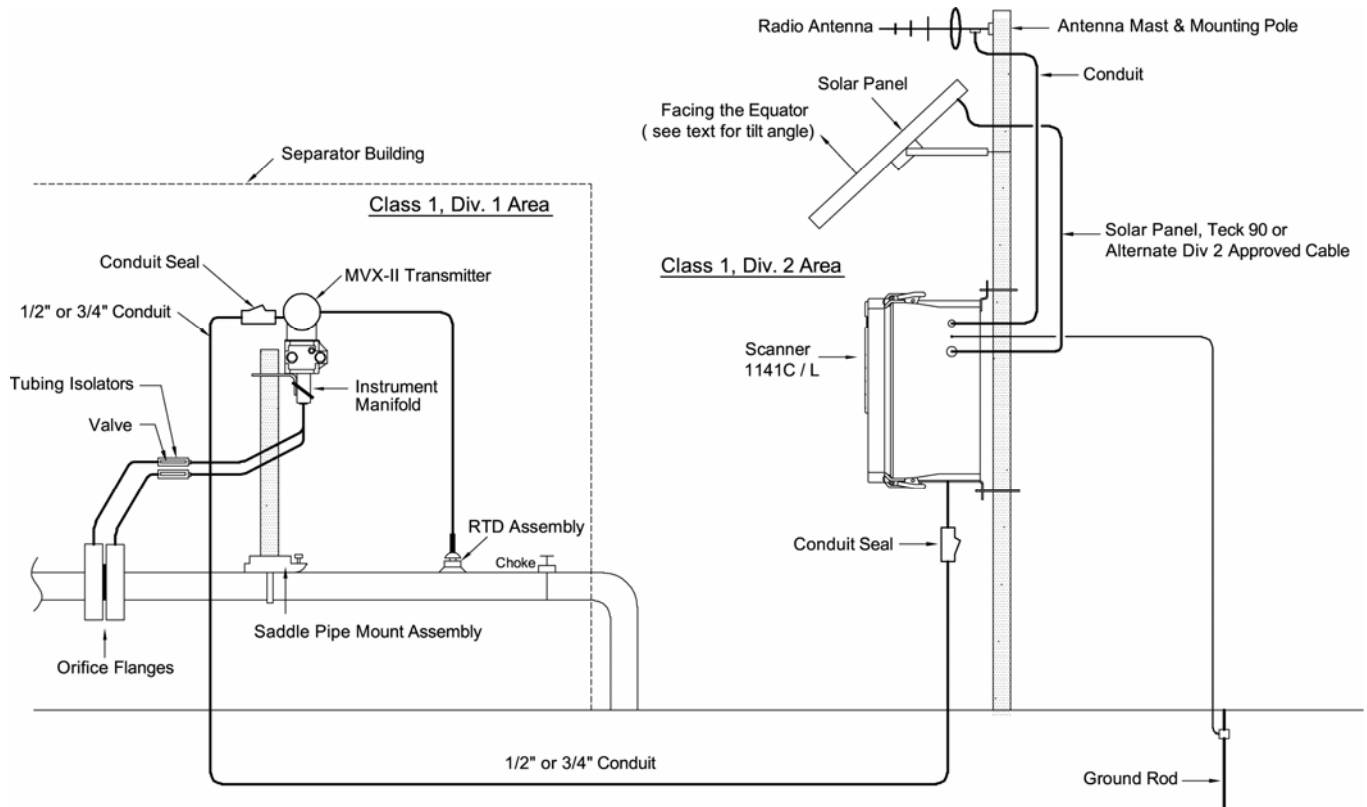


Figure 2.8—Typical installation of Scanner 1141C/L with remote communications

Installing and Connecting a Solar Panel

Mount the solar panel on a post facing the equator, or mount it directly to a flat surface (see chart below for tilt angles). At the equator, the mounting surface should face upward. Mount the panel high enough above the ground to prevent damage or tampering.

Site Latitude	Optimum Tilt Angle
0°	10°
5° - 20°	Latitude +5°
21° - 45°	Latitude +10°
46° - 65°	Latitude +15°
66° - 75°	80°

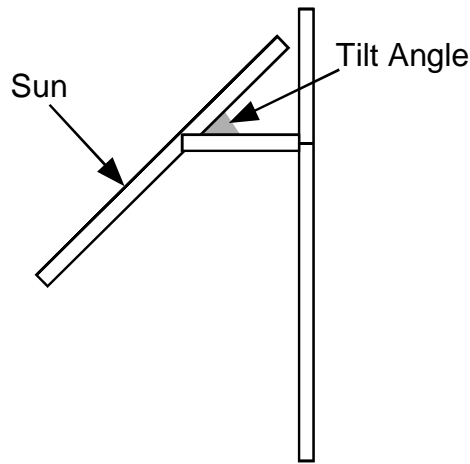


Figure 2.9—Tilt angles to be observed when mounting the solar panel

Note: Angles are marked on the bracket of the solar panel (0° - 90° tilt).

Connecting the Power Supply / Charge Controller

Power supply/solar panel wires enter the enclosure through the side or bottom conduit entry (Figures 2.5 and 2.6). Refer to [Outline Dimensions, page 91](#) for size and location of the conduit entry. The charge controller is integral to the main board.

See Figures 2.7 through 2.9 for reference to various installation types.

See [Appendix B: Control Drawings](#) for information about installation in a hazardous location.

Integral Charge Controller

For installation in Class I, Division 2 hazardous locations, the charge controller/power input are integral to the Scanner 1141 main board.



CAUTION

CAUTION

This caution is only applicable when a battery is connected to terminals 2 & 3 (BATT+ & BATT-)

The power supply must be current limited to 10 Amps maximum and also be short circuit protected.

All solar panels are short circuit capable and can therefore be used with the 1141, provided they do not exceed 10 Amps.

In normal operation the 1141's charging module will allow electrical current to flow to the battery unrestricted. The amount of current flow will vary depending on size of the battery and present charge level (voltage) of the battery and the voltage of the power supply.

The Scanner can be powered by a solar panel or a 6-28 VDC power supply (10 amps, max.). To connect power to the instrument, perform the following steps:

1. Wire the solar panel or power to the barrier terminal block in the back of the 1141 enclosure, connecting the red wire (+) to terminal 2 and the black wire (-) to terminal 3, as shown in Figure 2.8. For an 1141G, it is acceptable to wire directly to the Power+ and Power- terminals (terminals 2 and 3) in the top right corner of the main circuit board (Fig. 2.10)



Figure 2.10—Barrier terminal block for wiring a solar panel or power supply to the Scanner 1141

2. Open the ScanWin program and navigate to Setup> Scanner Setup>Power supply type to select the battery type used (Figure 2.11).

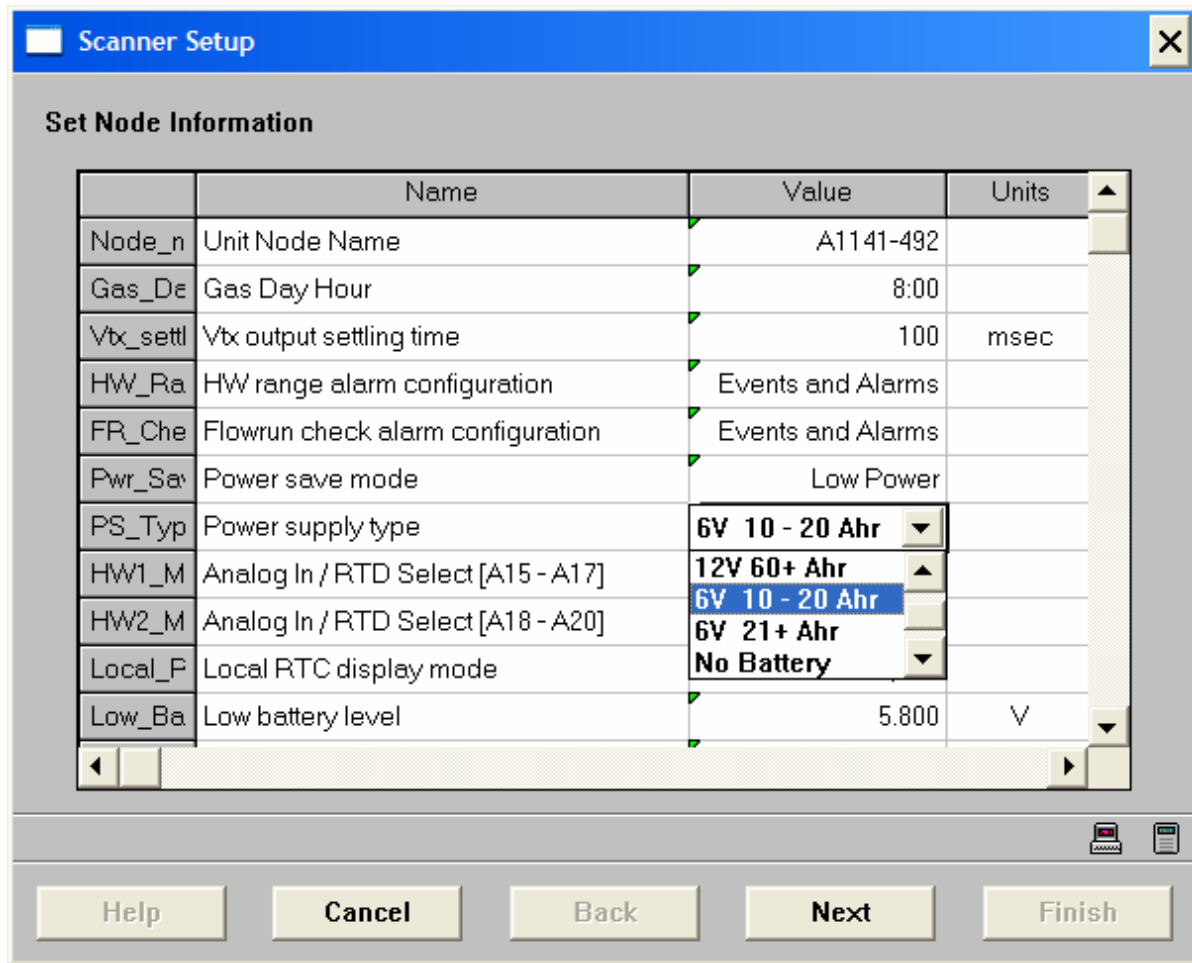


Figure 2.11—Power supply type selection

**CAUTION**

BEFORE CONNECTING A 6V BATTERY, MAKE SURE THE UNIT IS CONFIGURED FOR A 6V BATTERY. IF THE UNIT IS CONFIGURED FOR A 12V BATTERY, CONNECTING A 6V BATTERY TO IT COULD OVERCHARGE THE BATTERY. TO PREVENT AN ELECTRICAL SHORT, BEFORE SUPPLYING POWER TO THE UNIT, MAKE SURE THE LEADS FROM BATT + TERMINALS ARE NOT TOUCHING METAL OR EACH OTHER.

3. Connect a 6V or 12V battery to the Batt+ and Batt- terminals (terminals 4 and 5) as follows:
 - a. Connect the factory-installed wire (containing a 10-amp inline ¼ x 1 ¼-in. ABC-10 ceramic fast-blow fuse) extending from the Batt+ terminal (terminal 4) to the positive (+) terminal of the battery. A label including the model number for the fuse is attached to the wire for convenience in ordering replacement fuses (see Figure 2.12).

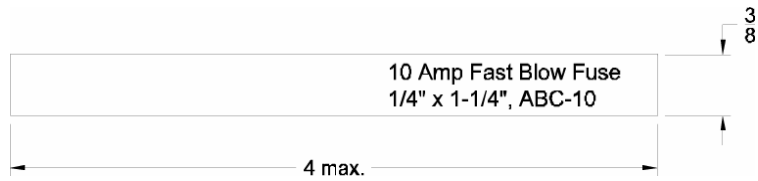


Figure 2.12—Label for identifying fast-blow fuse

- b. Connect the factory-installed black wire extending from the Batt- terminal (terminal 5) to the negative (-) terminal of the battery (Figure 2.13).

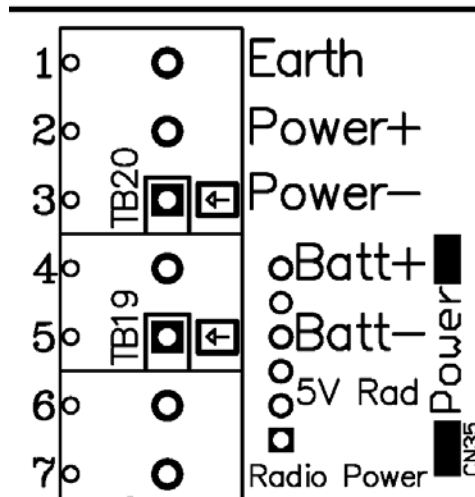


Figure 2.13—Battery connections on the main circuit board

See [Chapter 3: Main Circuit Board Wiring](#) for additional wiring information.

See [Appendix B: Control Drawings](#) for information about installation in a hazardous location.

Chapter 3: Main Circuit Board Wiring

Major Components

The main circuit board, located on the inside of the door on 1141C and 1141L models, contains all of the switches, jumpers, terminal blocks, and other connectors required for wiring the Scanner 1141 to a power supply, a charge controller, and communication devices, and for enabling the Scanner to utilize various input/outputs.

This section will describe each of the primary switches involved in configuring the operation of the Scanner 1141. Figure 3.1 provides a quick reference for locating switches, terminals, and other connectors.

In addition to the main board, an optional multipurpose I/O expansion board can be added to provide an additional MVT/RTD/TTL serial port, a 1-5V/4-20 mA analog output, a pulse input and up to 4 multi-interface pulse output/status input/outputs. For more information, see [Appendix D: Input/Output Expansion Board](#), page 107.

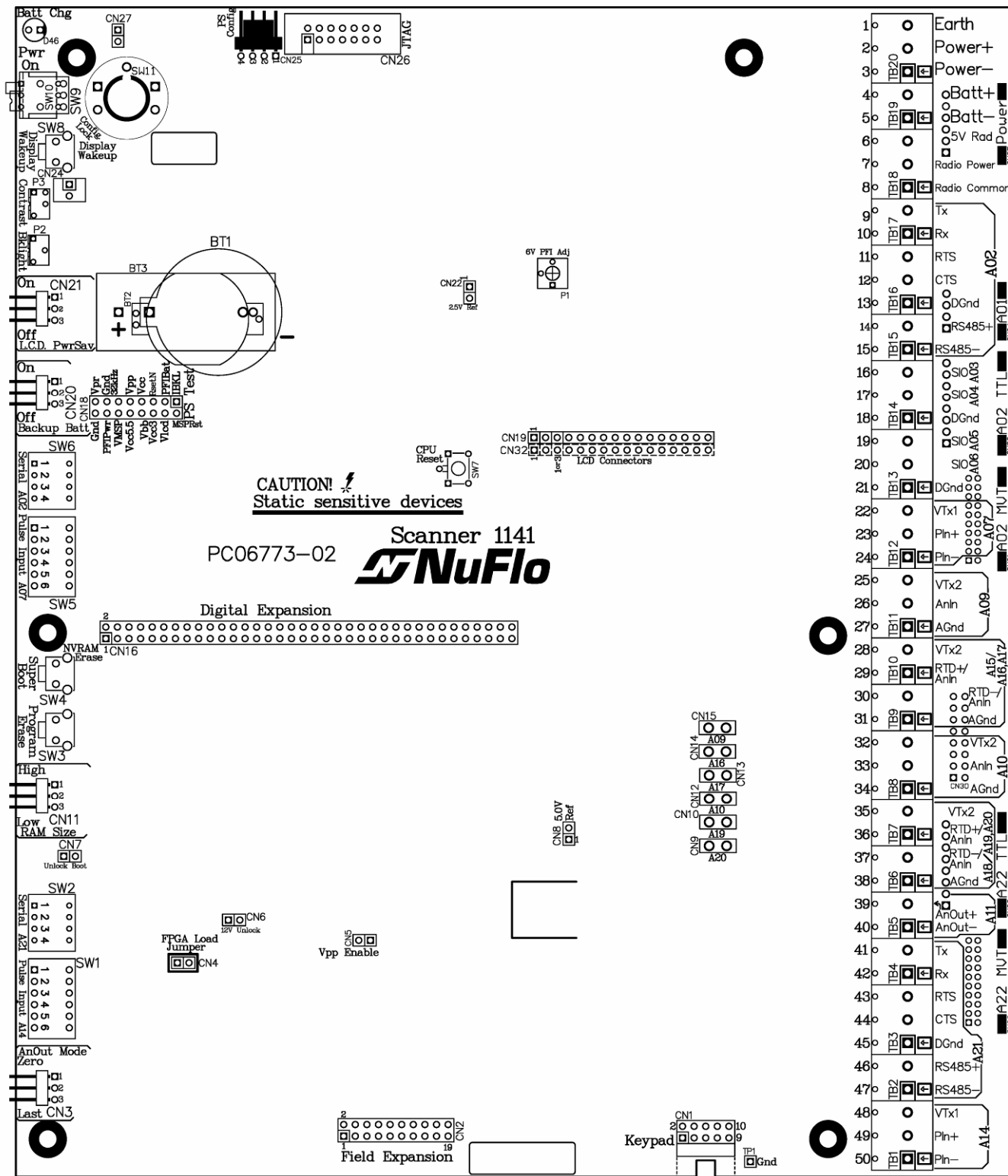


Figure 3.1— Scanner 1141 main circuit board

Switches, Jumpers, and Potentiometers

Note: It is very **IMPORTANT** that the following jumper settings be observed:

CN11 – “RAM Size” jumper; “High” is 96 kbytes, “Low” is 64 kbytes

CN20 – “Backup Batt” jumper; position across upper pins to enable backup battery power for non volatile memory (NVRAM).

CN21 - “LCD PwrSav” jumper; for optional backlight displays, position jumper across upper pins to shut off display when inactive; position jumper across lower pins to turn off backlighting only during periods of inactivity.

Table 3.1 summarizes the switches, jumpers and potentiometers located on the main board. They are organized in the order they appear on the board, from top to bottom along the left side of the board.

Table 3.1—Switches, Jumpers and Potentiometers

Component #	Description	Function	Step(s) for Enabling/Disabling
SW11	Config Lock	Prevents superbooting of the Scanner; prevents changes to many items in flow run configuration.	Tighten the screw to lock the switch. See Config Lock (SW11) page 31.
SW9	Pwr	Supplies power to the Scanner in the On position; provides for properly supervised system shutdown in the Off position.	Move switch in the “down” position to turn power off. Move switch in the “up” position to turn the power on.
SW8	Display Wakeup	Turns on the display when it has timed out and shut down	Press button to turn on the display.
P3	Contrast	Adjusts LCD contrast	Using a small slotted screwdriver, rotate the control clockwise to increase contrast; rotate counterclockwise to decrease contrast.
P2	Bklight	Adjusts backlight brightness (only functions if backlit option is installed)	Using a small slotted screwdriver, rotate the control clockwise to increase brightness; rotate counterclockwise to decrease brightness.
CN21	LCD PwrSav	Allows the display optional backlight to timeout (turn off) separate from the display, during periods of inactivity to conserve power.	Position jumper across upper pins for display and backlight timeout; position jumper across bottom pins for backlight only timeout.

CN20	Backup Battery	Enables and disables the lithium backup battery power to the NVRAM	Position jumper across upper pins to enable lithium backup battery; position jumper across bottom pins to disable lithium backup battery.
SW6	Serial Port A02	RS-485 termination and pullup/pulldown resistors	See Auxiliary Serial Ports , pg. 51.
SW5	Pulse Input A07	Supports frequency pulse inputs from turbine magnetic pickups, preamplified turbine signals, open-collector and contact closures with a debounce filter.	See Frequency Pulse Inputs , pg. 44.
SW4	Super Boot	Erases all configuration and flow data	Hold button in while turning power on.
SW3	Program Erase	Erases FLASH ROM application program so that new firmware can be FLASHED	Hold button in while turning power on.
CN11	RAM Size select	Determines how the system's base 256 Kbytes of memory is partitioned	Move jumper to "high" or top position to select 96K RAM and 164 Kbytes of NVRAM; move jumper to "low" or bottom position to select 64K RAM and 192 Kbytes of NVRAM.
SW2	Serial Port A21	RS-485 termination and pullup/pulldown resistors	See Auxiliary Serial Ports , pg. 51.
SW1	Pulse Input A14	Supports frequency pulse inputs from turbine magnetic pickups, preamplified turbine signals, open-collector and contact closures with a debounce filter.	See Frequency Pulse Inputs , pg. 44.
CN3	Analog Output mode	Analog output fail mode goes to zero or holds last value when Scanner 1141 is off.	When Scanner is turned off, with jumper in upper position (Zero), the output will go to approximately 1 mA. With jumper in lower position (Last), the output will be held in last known position.
CN4	FPGA Load Jumper	Enables programming of the FLASH memory "boot" block	Jumper should always be in place.

Below is a detailed description of the functions of each of the switches shown in Table 3.1.

Config Lock (SW11) The optional Configuration Lock switch (SW11) is legally required for custody transfer applications in some locations. When the Configuration Lock mechanism is installed, it is located beside the Power switch SW9. It consists of a locking hardware hex barstock with a spring and screw assembly affixed above a push-button switch. When the screw is tightened, the spring depresses the switch. As long as this button is depressed, the Scanner cannot be superbooted and most items in the flow run configuration cannot be changed.

To LOCK the switch, tighten the screw until a click is heard. Continue tightening the screw until it is possible to insert the sealing wire through the hex barstock/screw. Figure 3.2 shows the configuration locking mechanism with a seal wire passing through the standoff and screw.

To flash or superboot the Scanner 1141 RTU, switch SW11 must be in an UNLOCKED state.

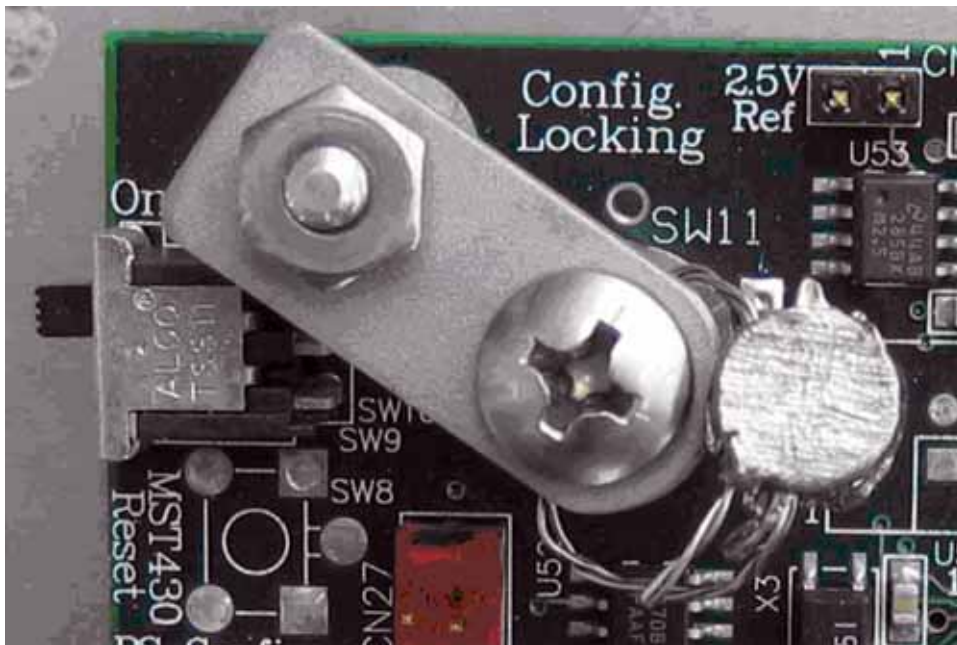


Figure 3.2— Configuration lock with seal wire in place

Pwr (SW9)

This switch performs a properly supervised system shutdown when placed in the OFF position. SW9 generates a power fail interrupt to the CPU and after a 10-ms delay, shuts the power off to the entire system board.

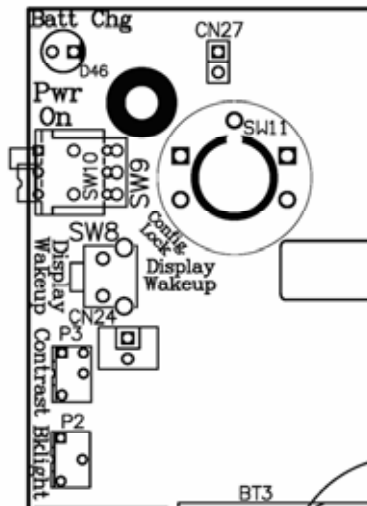
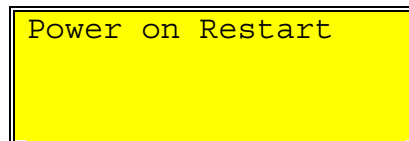


Figure 3.3— Switches SW9 and SW8, and potentiometers P3 and P2 (upper left corner of main board)

Placing SW9 in the ON position causes a “power on” restart. A “power on” restart interrupts the flow calculations but does not affect the configuration or historical flow data if the NVRAM lithium backup battery (CN20) is enabled. Power-on restarts are logged in the event log. The display will show:



Display Wakeup (SW8) If the display is configured to timeout and turn off, pressing the SW8 button will turn on the display. See Figure 3.3.

Contrast (P3) The LCD display contrast is adjusted by turning the screw. See Figure 3.3.

Bklight (P2) This potentiometer adjusts the brightness of a backlit display (available only on configurations with backlit display). See Figure 3.3.

LCD PwrSav (CN21) When a backlit display is configured to timeout and turn off, and the CN21 jumper is in the ON position, the display will turn off completely. When the CN21 jumper is in the OFF position, the backlighting will turn off, leaving the display on in a standard or non-backlit mode. See Figure 3.4.

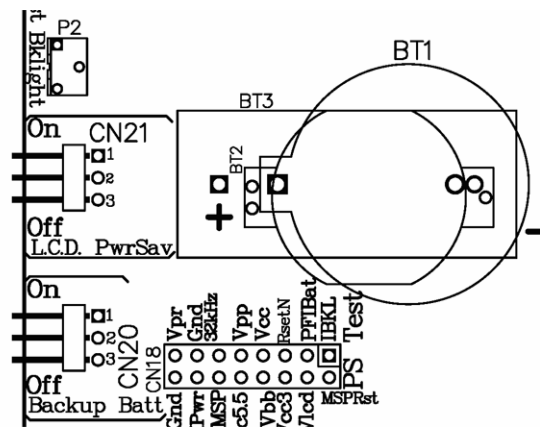


Figure 3.4— CN20 and CN21 connectors

Backup Batt (CN20) Jumper CN20 (Figure 3.4) enables and disables the lithium backup battery power to the NVRAM. The Scanner 1141 is shipped with the battery jumper in the OFF position. Set the jumper to ON before configuring the flow computer and leave the jumper in the ON position when the Scanner 1141 is in operation. Loss of input power while the jumper is OFF will scramble the entire contents of the NVRAM (including all configuration and flow data), and a “superboot” will be necessary.

Note: Storage of the Scanner with the lithium battery jumper (CN20) in the ON position will drain the lithium battery; if the lithium battery is drained, it must be replaced. If the computer is stored without power for extended periods (i.e. a week or more), set the jumper CN20 to OFF.

Serial Port A02 (SW6) Serial port A02 (shown in Figure 3.5) is one of two auxiliary serial ports (see also Serial Port A21) that can be software-configured to support either RS-485 or RS-232C communications, depending on which hardware options are installed. (Refer to the ScanWin manual, *Chapter 7: About the System*).

For RS-485 communications, Resource A02 uses SW6 with terminals 14 and 15; if these terminals are not present, the RS-485 option is not installed.

Switch 1 termination enabled when switch is closed. Termination can be used if this is the last device in the RS485 loop, With low baud rates of 19200 bps the termination is not normally required.

Switch 2 pullup resistor enabled when switch is closed. Used with switch 3.

Switch 3 pulldown resistor enabled when switch is closed. Used with switch 2.

For RS-232 communications, Resource A02 uses SW 6 and terminals 9 through 12; if these terminals are not present, the RS-232 option is not installed.

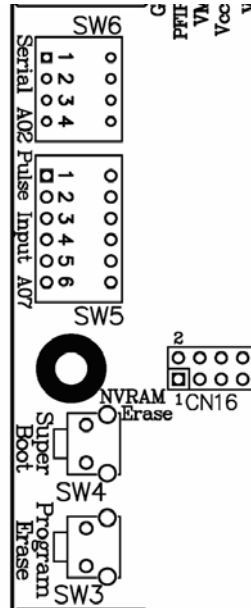


Figure 3.5—Switches SW6, SW5, SW4 and SW3

Serial Port A21 (SW2) Auxiliary serial port A21 (shown in Figure 3.6) is one of two auxiliary serial ports (see also Serial Port A02) that can be software-configured to support either RS-485 or RS-232C communications, (refer to the ScanWin manual, *Chapter 7: About the System*).

For RS-485 communications, Resource A21 uses SW2 with terminals 46 and 47; if these terminals are not present, the RS-485 option is not installed.

For RS-232 communications, Resource A21 uses SW2 and terminals 41 through 44; if these terminals are not present, the RS-232 option is not installed.

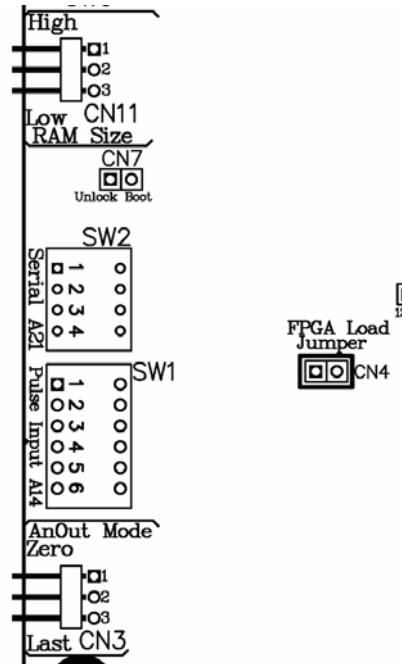


Figure 3.6— CN11 jumper, SW2, SW1, CN3, and FPGA Load jumper

Pulse Input (SW5)

SW5 is a six-position DIP switch that allows the user to configure the desired electrical interface. Resource A07 uses terminals 23-24 and SW5 of the DIP switch. If these terminals are not on the main board, the frequency pulse input option is not installed. See [Frequency Pulse Inputs](#), page 44, for DIP switch settings and wiring diagrams for various electrical interfaces.

Super Boot (SW4)

When the SW4 button is pressed (Figure 3.5) and the Scanner 1141 is turned on, a “superboot” occurs. A “superboot” erases all configuration and flow data and is required when first commissioning the unit [after turning the NVRAM battery switch (CN21) on].

A superboot is required for changes to the RAM Size jumper (CN11) settings to become effective. (See RAM Size description on page 36.) When the SW4 is not pressed and the Scanner 1141 is turned on, a normal restart occurs, as described in [Startup Procedure](#), page 55.

For more information, see [Superbooting the Scanner](#), page 55.

Program Erase (SW3)

SW3 enables programming of the FLASH memory array by connecting the +12V programming voltage to the VPP pin of each of the FLASH memory devices. **Unless new firmware is being downloaded to the system, do not press SW3 when the power is turned on.**

RAM Size (CN11)

This jumper determines how the system's base 256 Kbytes of memory is partitioned. Note the "high" and "low" markings on the circuit board (Figure 3.6). Position the jumper across the top two pins to select the "high" setting; position the jumper across the bottom two pins to select the "low" setting.

"Low" is 64 Kbytes of RAM and 192 Kbytes of NVRAM.

"High" is 96 Kbytes of RAM and 164 Kbytes of NVRAM.

A superboot is required for a change in the RAM size jumper to become effective.

Pulse Input A14 (SW1)

SW1 is a six-position DIP switch that allows the user to configure the desired electrical interface (Figure 3.6). Resource A14 uses terminals 49-50. If these terminals are not on the main board, the frequency pulse input option is not installed. See [Frequency Pulse Input DIP Switch Summary](#), page 44, for DIP switch settings and wiring diagrams for various electrical interfaces.

Analog Output Mode (CN3)

CN3 is for an optional single 4-20 mA analog output (Figure 3.6). The output is wired to terminals 39 and 40. If these terminals are not present on the main circuit board, the 4-20 mA analog output option is not installed. When the Scanner is turned off (and there is still power to the loop) and the jumper is in upper (Zero) position, the output will go to approximately 1 mA. With the jumper in the lower (Last) position, the output will be held in the last known position.

FPGA Load Jumper (CN4)

Jumper CN4 enables programming of the FLASH memory "boot" block (Figure 3.6). This block contains 4 Kbytes of code used to download the flow computer's application, as well as 4 Kbytes of memory used to define the operation of the FPGA (during application downloading). **The CN4 jumper is set when the Scanner is initialized at the factory and should not be changed.**

Field Wiring Termination

Table 3.2—Terminals on the Main Board

Source	Terminal #	Description
	1	Earth ground
Charging Power	2	Power+
	3	Power -
Battery Connections	4	Batt+, Battery or DC power supply +
	5	Batt-, Battery or DC power supply, return or -
	6	5V Rad, 5 VDC @ 200 mA supply, turned off by radio power save
Radio Power	7	BattRad, Battery voltage, turned off by radio power save
	8	RadCom, Signal Common or return for radio power
	9	Tx – RS-232C transmit output
	10	Rx – RS-232C receive input
	11	RTS – RS-232C request to send (RTS) output
A02 Serial Port	12	CTS – Auxiliary serial port clear to send (CTS) input
	13	DGnd – Digital ground
	14	RS-485+
	15	RS-485-
A03 Status I/O	16	SIO – Status input/output
A04 Status I/O	17	SIO – Status input/output
	18	DGnd – Signal common
A05 Status I/O	19	SIO – Status input/output
A06 Status I/O	20	SIO – Status input/output
	21	DGnd – Signal common
	22	VTx1 – Power for transmitters
A07 Pulse Input	23	Pin+, Pulse input positive
	24	Pin-, Pulse input negative
	25	VTx2 – Power for transmitters
A09 Analog Input	26	AnIn – Analog input
	27	AGnd – Analog ground
	28	VTx2 – Power for transmitters
A15, A16, A17 RTD/Analog Input	29	RTD+/ Anin – RTD+ for A15, or Analog input A16, firmware select
	30	RTD-/ Anin – RTD- for A15, or Analog input A17, firmware select
	31	AGnd – Analog ground
	32	VTx2 – Power for transmitters
A10 Analog Input	33	AnIn – Analog input
	34	AGnd – Analog ground
	35	VTx2 – Power for transmitters

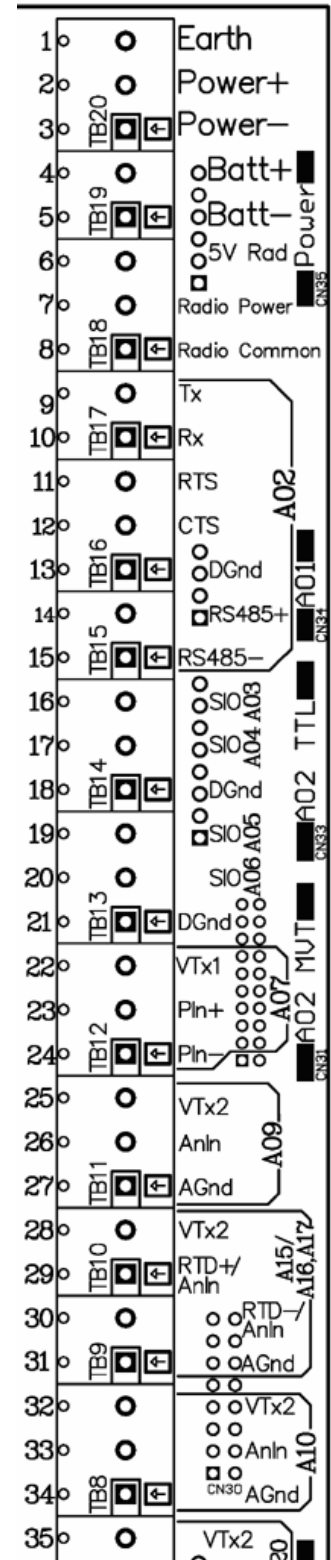


Table 3.2—Terminals on the Main Board

Source	Terminal #	Description
A18, A19, A20 RTD/Analog Input	36	RTD+/ AnIn, RTD+/- are one temperature input or 2 analog inputs
	37	RTD-/ AnIn, RTD+/- are one temperature input or 2 analog inputs
	38	AGnd – Analog ground
A11 Analog Output	39	AnOut+, Analog output +
	40	AnOut-, Analog output -
A21 Serial Port	41	Tx – RS-232C transmit output
	42	Rx – RS-232C receive input
	43	RTS – RS-232C request to send (RTS) output
	44	CTS – Auxiliary serial port clear to send (CTS) input
	45	DGnd – Digital ground
	46	RS-485+
A14 Pulse Input	47	RS-485-
	48	VTx1, power for transmitters
	49	Pin+, Pulse input positive
	50	Pin-, Pulse input negative

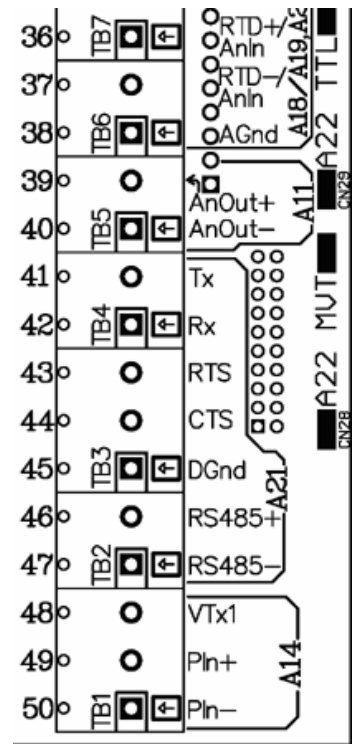


Table 3.3—Inputs Requiring Connectors

Source	Location
A01 Serial Port	4-pin Molex connector, adjacent to terminals 12 - 15
A08 RTD	RTD as part of serial MVT/RTD (A22 MVT), terminals are on the round interconnect board located near the MVT
A12 (A22 MVT)	MVT-DP, connected by a 20-conductor ribbon cable
A13 (A22 MVT)	MVT-SP, connected by a 20-conductor ribbon cable

Wiring Diagram Summary

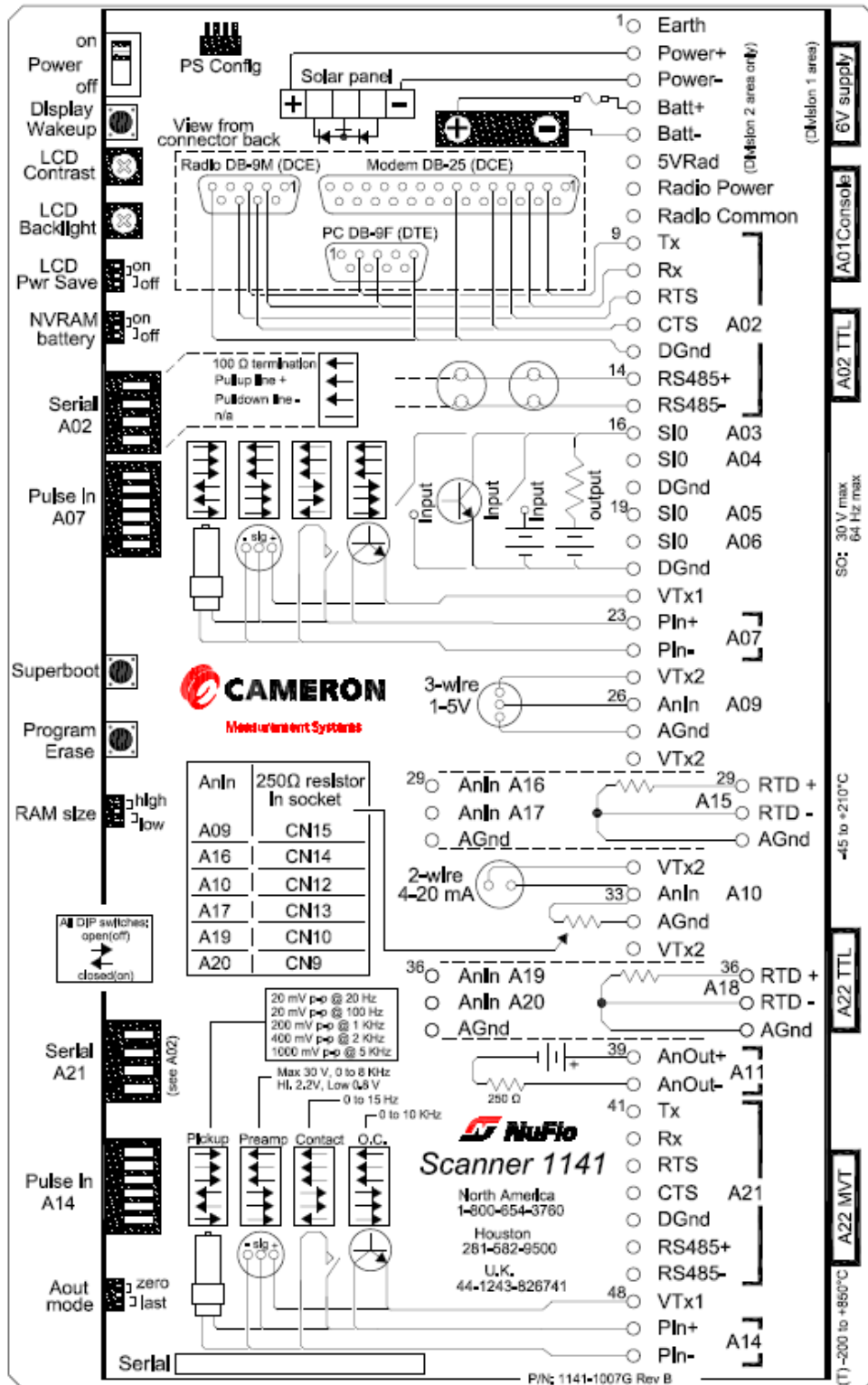


Figure 3.7—Main circuit board wiring summary

MVT/RTD Input

The serial MVT is connected to the Scanner 1141 via an interconnect board that also provides an RTD input.

Resource A22 MVT Serial TTL port (connector CN28) on the Scanner 1141 main board connects to the round interconnect/SI assembly with a keyed 20-conductor ribbon cable. The SI board and interconnect board are joined via a connector and a ribbon cable, as shown in Figure 3.8. The MVT connects to the round SI board in back of the interconnect board.

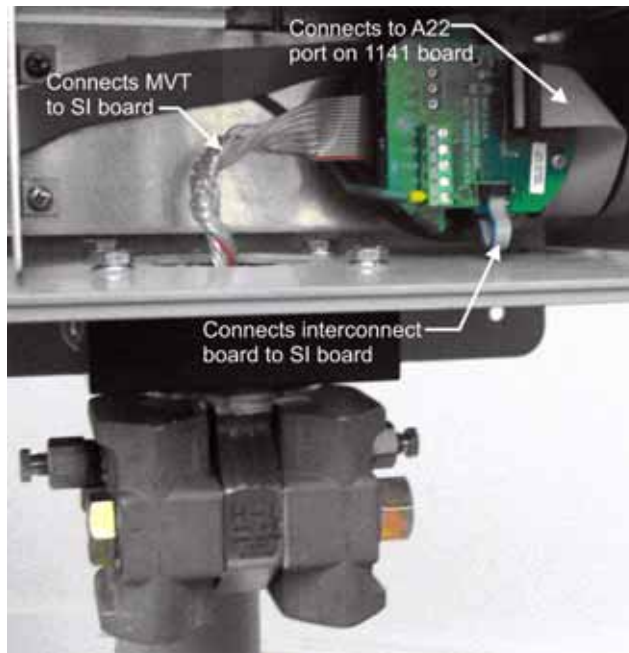


Figure 3.8—Serial MVT connections

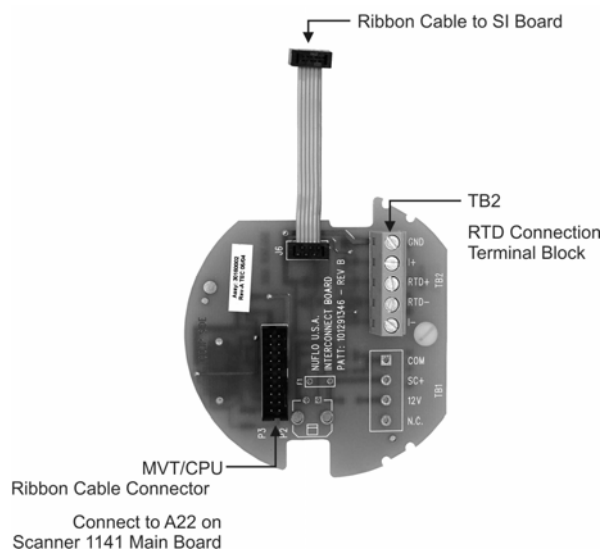


Figure 3.9— MVT-to-interconnect board connections

RTD Inputs

MVT RTD

RTD input A08 is present on Scanner 1141s that have a direct-mount MVT sensor. The MVT comes with an interconnect board that accepts two-wire, three-wire and four-wire 100-ohm RTDs. When two- or three-wire RTDs are used, jumper wires must be installed (Figure 3.10). The RTD wiring is connected to terminal block TB2 on the interconnect board.

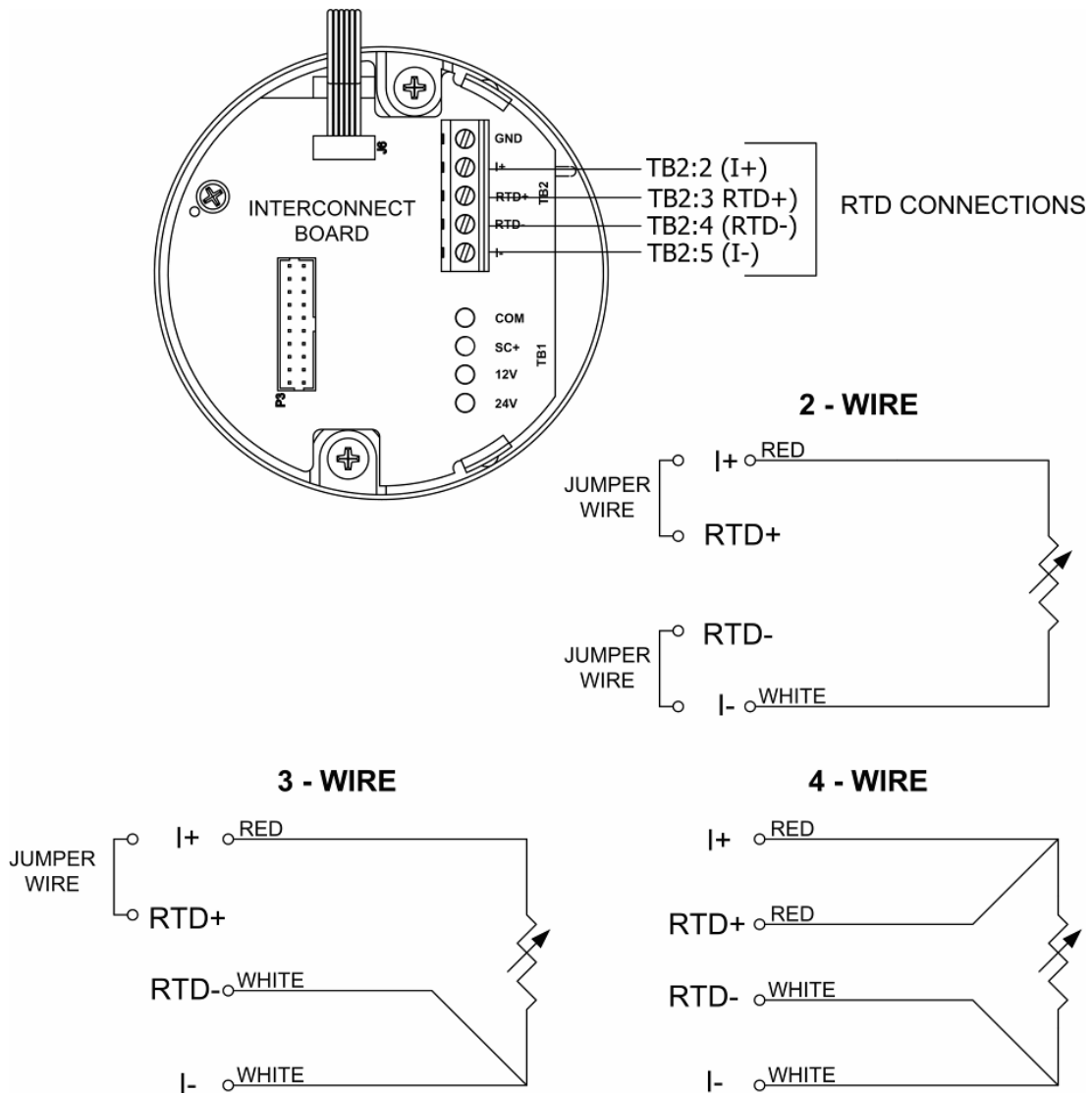


Figure 3.10— RTD connections via MVT interconnect board

Main Circuit Board RTD



WARNING – EXPLOSION HAZARD

WHEN A 4-WIRE RTD IS INSTALLED ON THE MAINBOARD, CUT OFF ONE OF THE RTD LEADS (TYPICALLY ONE OF THE RED LEADS) AND APPLY HEAT SHRINK TO THE END OF THE CUT WIRE TO PREVENT CONTACT WITH ANYTHING THAT COULD CAUSE A SPARK.

Resources A15 and A18 connect to a 100-ohm, 3-wire platinum RTD. The RTD characteristic curve is software-selectable for temperature coefficients of. 0.00385 ($\Omega/\Omega/^\circ\text{C}$) DIN or by performing a loop calibration at a single point or three or more points. For more information, refer to the ScanWin manual, *Chapter 3 – Calibrate/Verify Devices*.

Platinum 2-wire RTDs can be used by jumping the lead-line compensation terminals together.

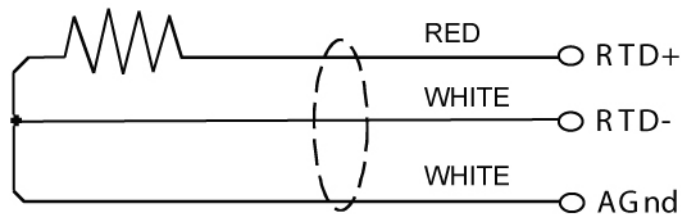


Figure 3.11—Wiring diagram for platinum 3-wire RTDs

Analog Inputs

Each main circuit board RTD can be configured as two analog inputs using ScanWin Scanner Setup wizard and using the selection box for Analog In / RTD Select. See Figure 3.12 below.

RTD Resource A15 can be configured as Analog input resource A16 and A17.

RTD Resource A18 can be configured as Analog input resource A19 and A20.

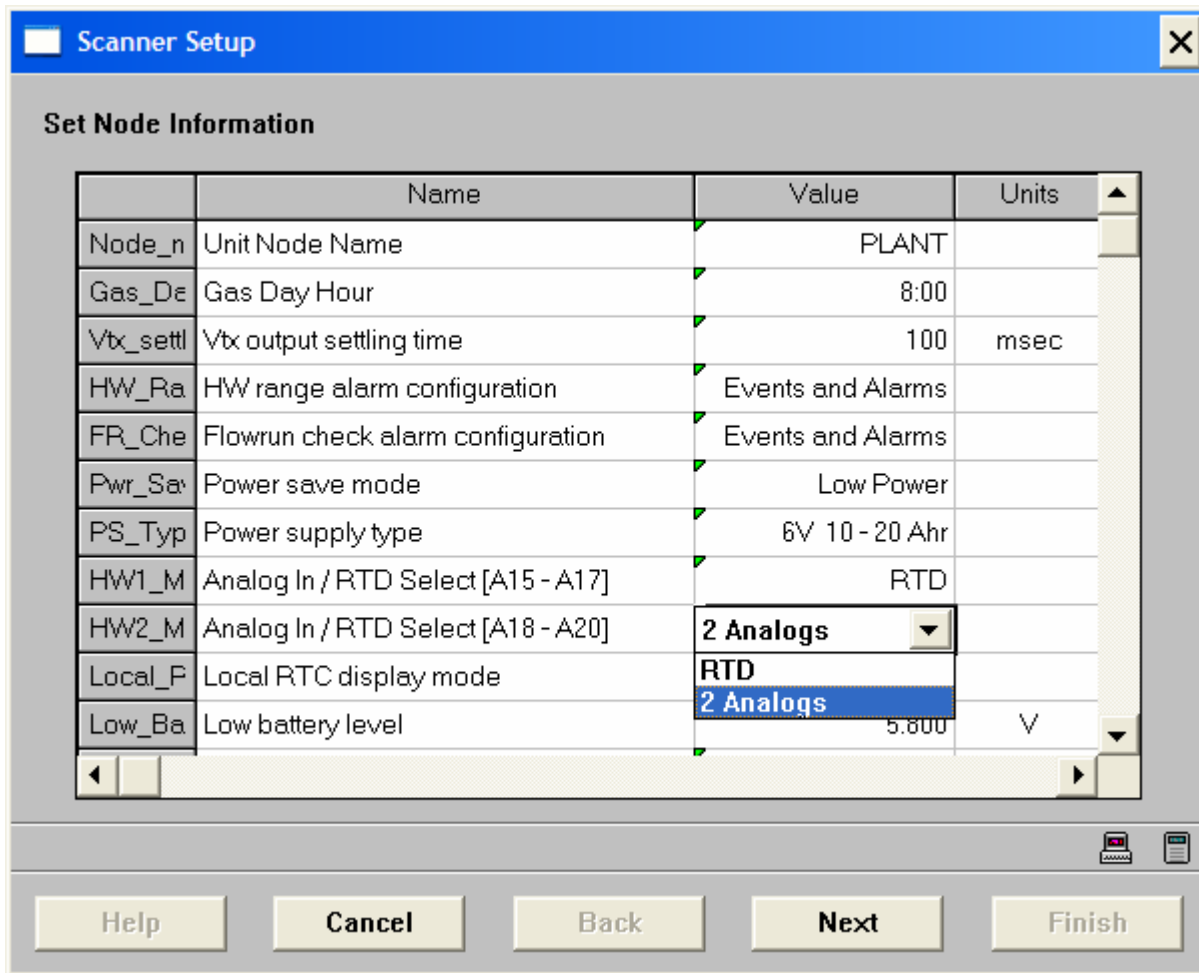


Figure 3.12—ScanWin Scanner Setup dialog

Analog 1-5 VDC Transmitter

(Non-incendive)

The use of conventional 1-5 VDC transmitters requires no load resistors (Figure 3.13). Power for the circuit is normally obtained from the Scanner's internal power supply, but may also be drawn from an external source. The configuration is non-incendive when used with an approved transmitter. Refer to [Appendix B: Control Drawings](#) for a list of approved transmitters.

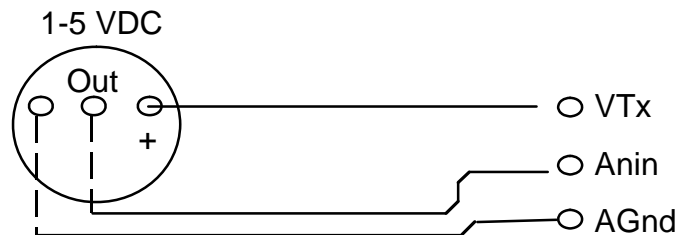


Figure 3.13—Wiring diagram for 1-5 VDC transmitter

Analog 4-20 mA Transmitter

Use of conventional 4-20 mA transmitters requires the addition of precision 250-ohm load resistors on each analog channel (Figure 3.14). Power for the current loop is normally drawn from an external source.

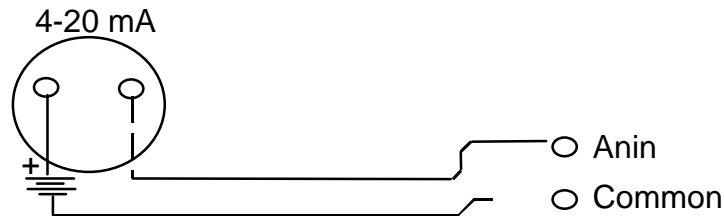


Figure 3.14—Wiring diagram for 4-20 mA analog transmitter

In some configurations, sockets on the main board can be used to install the precision resistors. Sockets are not installed in all configurations.

Table 3.4—Socket Identification

Resource	Socket
A09	CN15
A16	CN14
A17	CN13
A10	CN12
A19	CN10
A20	CN9

Frequency Pulse Inputs

The Scanner 1141 frequency pulse inputs interface with a variety of pulse-producing sources including turbine magnetic pickups, preamplified turbine signals, as well as open collector and contact closures with a debounce filter. Each of these input types are discussed on the following pages.

Frequency Pulse Input DIP Switch Summary

A six-position DIP switch at the left edge of the main circuit board allows the user to configure the desired electrical interface.

Resource A07 uses terminals 23-24 and DIP switch 5 (SW5). Resource A14 uses terminals 49-50 and DIP switch 1 (SW1). If these terminals are not on the main board, the frequency pulse input option is not installed.

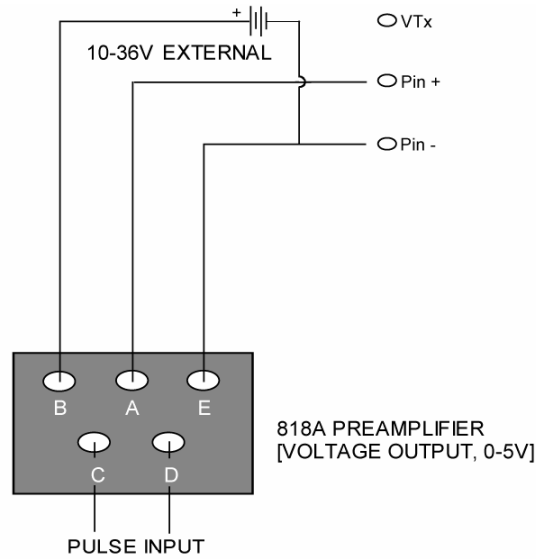
Table 3.5 summarizes the function of each switch on the Frequency Pulse Input switch (SW1 and SW5):

Table 3.5—DIP Switch Functions for Frequency Pulse Input SW1 and SW5

Position #	Closed (ON)	Amplified and Contact Closure	Magnetic Pickup Coil
1	Connects Pin- to circuit ground.	Closed (On)	Open (Off)
2	For open collector and dry contact inputs, connects Pin+ to a 5V pull-up resistor and input divider; can also be closed for amplified signals.	Closed (On)	Open (Off)
3	Connects the high-level signal from Pin+ to the comparator circuit that squares up the waveform.	Closed (On)	Open (Off)
4	For turbine meter magnetic pickup coil signals, connects the Pin+ terminal to an amplifier.	Open (Off)	Closed (On)
5	For turbine meter magnetic pickup coil signals, connects the output of the flow computer's pulse preamplifier to signal comparator for low-level signals.	Open (Off)	Closed (On)
6	Debouncing - input sampling at 32 Hz allows detection of signals up to 16 Hz (higher frequency pulses generated by contact bounce will be rejected).	Closed (On) – for dry contact inputs	Open (Off)

Three-Wire Preamplified Turbine (Barton 818) 0-5V Input

This is suitable for use with the Barton 818A preamplifier configured for voltage output mode. This preamplifier provides a transmission of up to 30 mA.



NOTE: A 24V EXTERNAL POWER SUPPLY SHOULD BE USED TO DRIVE THE 818A PREAMPLIFIER. THE 1141 VTX (APPROX. 12V) IS NOT SUFFICIENT TO POWER THE PREAMPLIFIER.

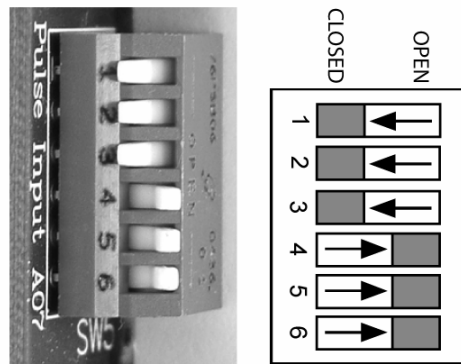
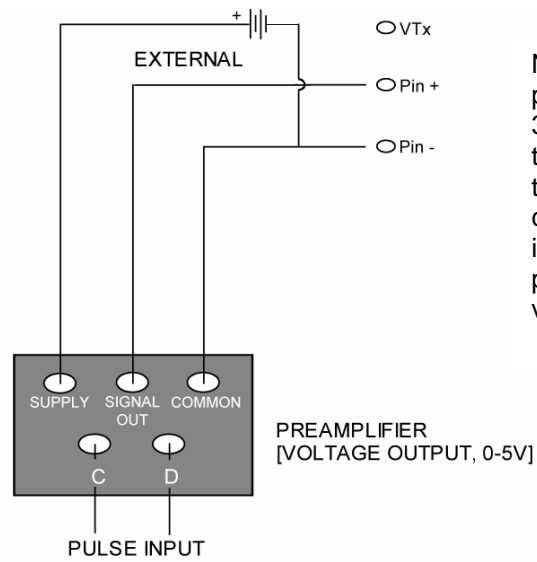


Figure 3.15—DIP switch settings and wiring diagram for 818A preamplifier output



NOTE: If the preamplifier can be powered by 12v at less than 30mA, the Scanner 1141's VTX2 transmitter supply may be used to power the preamplifier. VTX1 can be used if the preamplifier input can be the higher of the power input and the battery voltage.

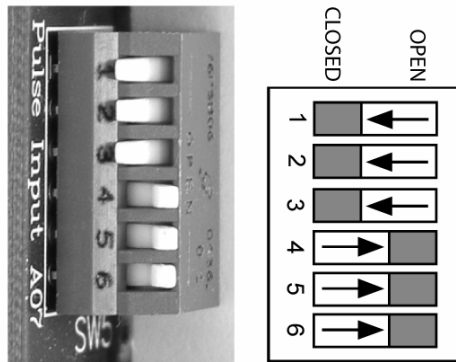
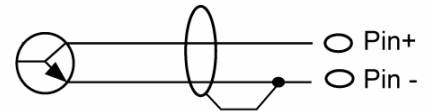


Figure 3.16—DIP switch settings and wiring diagram for pre-amplified turbine 0-5V output

Open Collector without “Bounce”

This mode provides a generic pulse input that is compatible with a variety of pulse-producing devices and other end devices. A suitable end device is one that provides a bounce-free solid-state output stage, such as an open collector transistor or open-drain MOSFET.



Frequency Range: 0 to 10 kHz

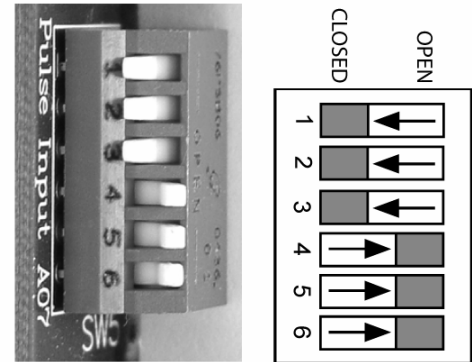
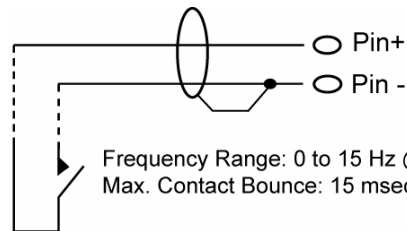


Figure 3.17—DIP switch settings and wiring diagram for an open collector output (without bounce)

Dry Contact with “Bounce”

In this mode, the pulse input is connected to any device that provides a passive contact closure, such as a reed relay or microswitch. Excitation is provided by the Scanner 1141. Debouncing circuitry limits the input frequency to 15 Hz maximum.



Frequency Range: 0 to 15 Hz @ 50% duty cycle
Max. Contact Bounce: 15 msec

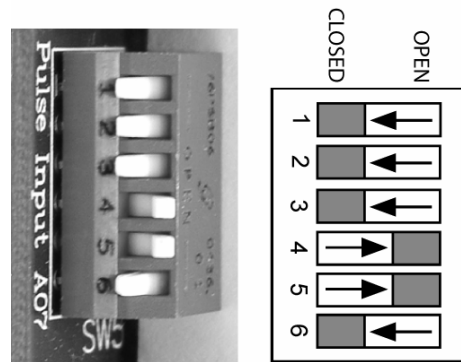
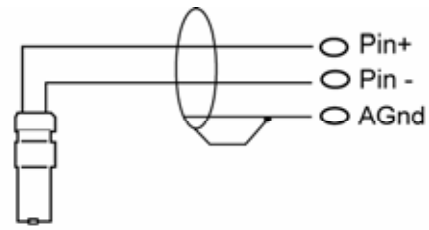


Figure 3.18—DIP switch settings and wiring diagram for a dry contact output (without bounce)

Magnetic Pickup Coil

(Non-incendive)

In this mode, the pulse input is directly connected to a standard variable-reluctance pickup coil. It is used on NuFlo gas and liquid turbine meters and other meters of similar design. The input uses a difference amplifier that provides common mode rejection, allowing the Scanner to operate with accuracy in noisy environments. Shielded cable such as Belden 9322 is required.



Input Impedence: 10K @ 1 kHz
(signal < 1000 mV p-p)

Input Sensitivity: 20 mV p-p @ 20 Hz
20 mV p-p @ 100 Hz
200 mV p-p @ 1000 Hz
400 mV p-p @ 2000 Hz
1000 mV p-p @ 5000 Hz

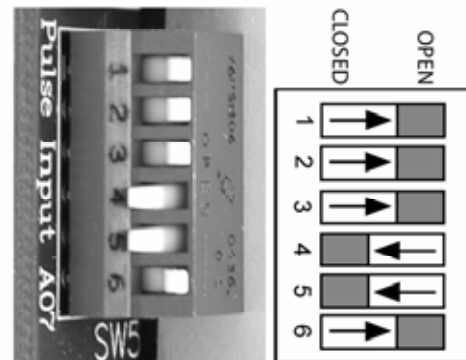


Figure 3.19—DIP switch settings and wiring diagram for a magnetic pickup coil output

Status Inputs and Outputs

Status input resources A03, A04, A05 and A06 are used to read the state of an external device, which can be either passive (e.g. contact closures) or active where excitation is provided by an external source.

- When a passive input is selected, an internal power source attempts to drive a 50-mA current through the circuit. The voltage through this circuit is limited to 3.2 VDC.
- When an active input is selected, the user can select a voltage threshold of 2, 7 or 10 volts. Below the threshold, the input will be false (off); above the threshold, the input will be true (on).

Outputs are used for status (e.g. alarms) or pulse train (e.g. accumulated volume) and are selected via ScanWin software. The circuits are suitable for a variety of end devices including small inductive loads such as electromechanical counters. The output circuits have limited protection against inductive “kickback” from such devices, but additional safety can be achieved by strapping a diode across the load. Current requirements in excess of 100 mA require the use of interposing relays. Excitation should be drawn from an external source.

Resources A03 through A06 are capable of both status inputs and outputs (Figure 3.20).

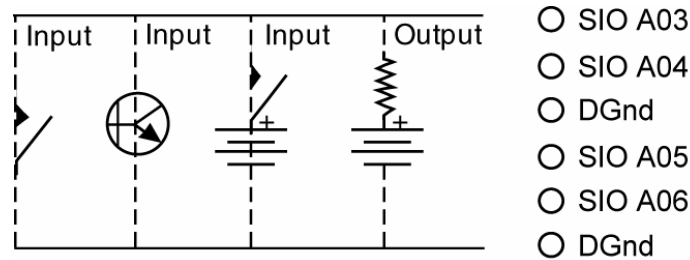


Figure 3.20—Wiring diagram for status inputs/outputs

Analog 4-20 mA Output (Optional)

An optional single 4-20 mA analog output is available (Figure 3.21). To determine if the analog output is installed, inspect the board for terminals 39 and 40. If they are not present, the option is not installed.

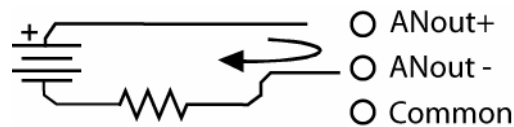


Figure 3.21—Wiring diagram for analog 4-20 mA output

If the analog 4-20 mA output is not installed, one can be obtained via the addition of an expansion board. See [Appendix D: Input/Output Expansion Board](#), page 103.

Console Serial Port

The console port is accessed through the 4-pin A01 connector (CN34) located on the underside of the main board, on the terminal block side. This port is wired to a connector accessed from the bottom of the enclosure, and is typically used with a console device, such as a PC. As shown in Figure 3.22, the console serial port connector is protected by a tool-secured cover. By loosening one of two screws, the operator can pivot the top cover plate to the side for direct access to the connector.



Figure 3.22—Console serial port connector shown with the cover in place at the bottom of the Scanner 1141 enclosure (left) and shown with the cover unlatched (right)

Auxiliary Serial Ports

The auxiliary serial ports (Resources A02 and A21) can be software-configured to support either RS-485, RS-232C communications, as shown in the ScanWin screen capture (Figure 3.23). Resources A02 and A22 also support TTL communications, depending on which hardware options are installed. The auxiliary RS-485 serial port switches (SW2 and SW6) are located along the left edge of the circuit board with the other jumpers and switches, opposite the terminal blocks.

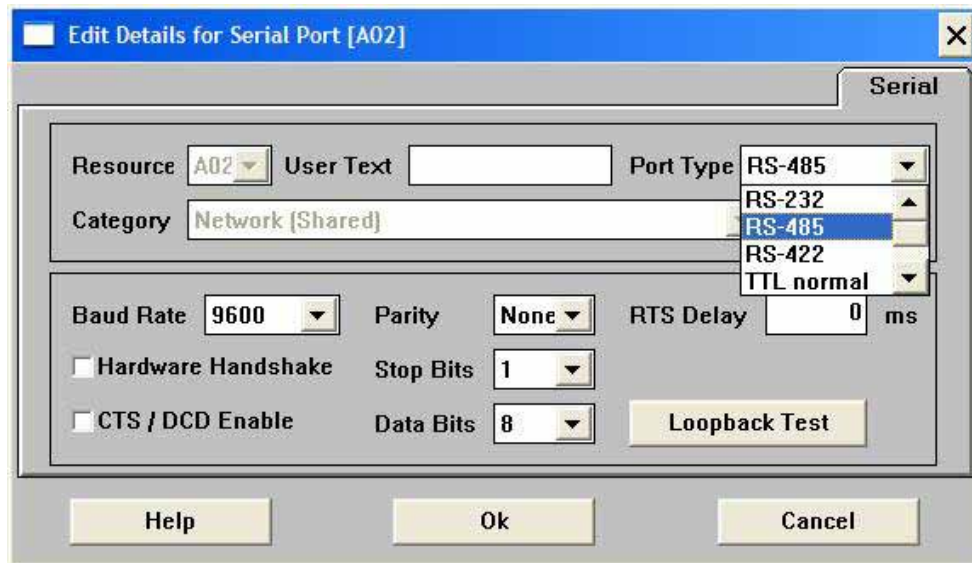


Figure 3.23—ScanWin Edit Details for Serial Port

For RS-485 communications, Resource A02 uses SW6 and terminals 14 and 15; resource A21 uses SW2 and terminals 46 and 47. If these terminals are not present, the RS-485 option is not installed.

For RS-232 communications, Resource A02 uses SW 6 and terminals 9 through 12; resource A21 uses SW 2 and terminals 41 through 44. If these terminals are not present, the RS-232 option is not installed.

For TTL communications, Resource A02 uses connector CN33; resource A22 uses connector CN29. If these connectors are not present, the TTL option is not installed.

These serial ports can be used with a modem, radios, or satellites for remote communication or peripheral devices such as the NuFlo MVX[®] or MVX[®]-II multivariable transmitters, Daniel gas chromatographs and ultrasonic meters to provide additional inputs via serial ports. (For more information, refer to ScanWin manual, *Chapter 7: About the System*).

Either auxiliary serial port can be configured as a second console port for remote console, a network port, or slave ports for connection to Modbus devices or other peripheral devices. (For more information, refer to ScanWin manual, *Chapter 7: About the System*).

When the Scanner is set to operate in low-power mode (via the ScanWin software System tab), the serial interface allows the output signals (TX and RTS) to be “powered-down” under software control to reduce power consumption when the serial port is inactive. The receivers remain active even when the transmitters are powered down, allowing these inputs to transition from “on” to “off” to “wake-up” the serial port.

RS-232C Auxiliary Serial Port

When resource A02 or A21 is configured to support RS-232 communications, the following wiring diagrams can be used to connect to a modem or radio (DCE), or directly to a PC (DTE).

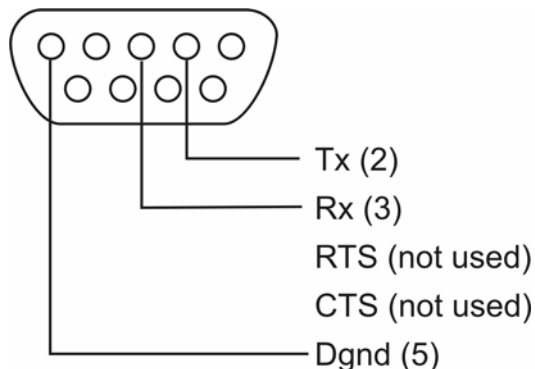


Figure 3.24—Wiring diagram for connecting auxiliary serial port A02 or A21 directly to a PC using a DB-9 (DTE) connector

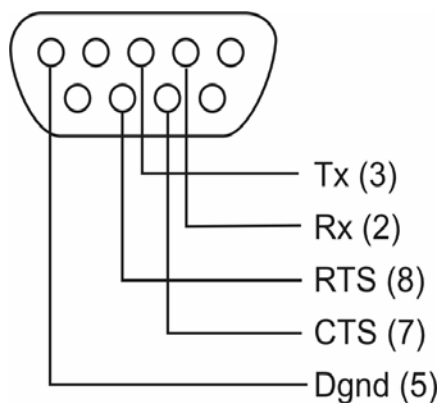


Figure 3.25—Wiring diagram for connecting auxiliary serial port A02 or A21 to a radio using a DB-9 (DCE) connector

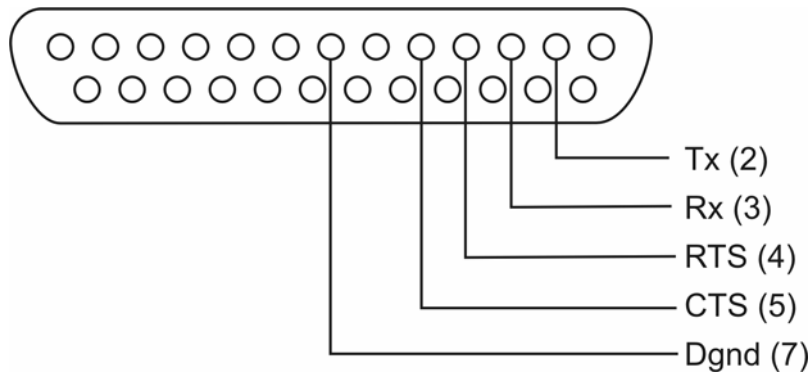


Figure 3.26—Wiring diagram for connecting auxiliary serial port A02 or A21 to a modem using a DB-25 (DCE) connector

Table 3.6—Terminal Connections for 9-pin and 25-pin RS-232 Cables

Terminal	RS-232C (9-pin DTE)	RS-232C (9-pin DCE)	RS-232C (25-pin DCE)
Tx	2	3	2
Rx	3	2	3
RTS	—	8	4
CTS	—	7	5
DGnd	7	9	7

RS-485 Auxiliary Serial Port DIP Switches

Table 3.7—Functions and Settings for RS-485 Auxiliary Serial Ports (SW2 and SW6)

SW/Position #	Description	ON	OPEN – OFF
SWx-1	AC couple 100-ohm termination resistor ¹	Selected	Deselected
SWx-2	Pull-up resistor	Selected	Deselected
SWx-3	Pull-down resistor	Selected	Deselected
SWx-4	Not used	—	—

¹ Can be used if Scanner 1141 is the last device on the loop, but not normally required for communications rates of 19200 bps or less.



Figure 3.27—Auxiliary serial port switch with all RS-485 connections enabled

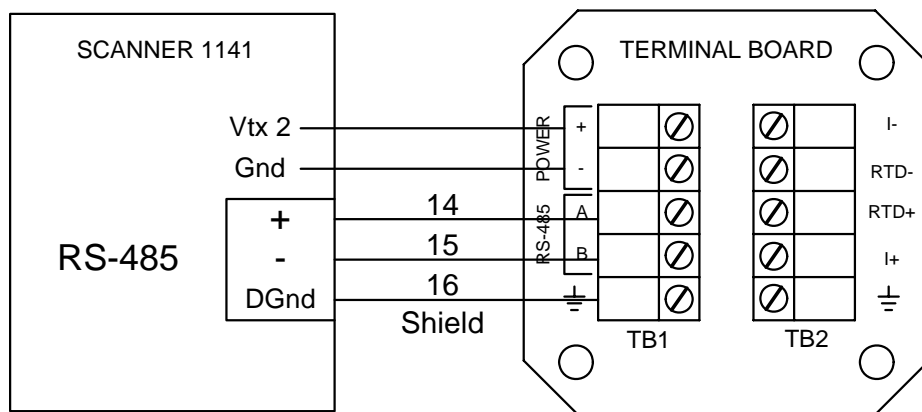


Figure 3.28—MVX-II wiring diagram for auxiliary serial port configured for RS-485 communications

Up to two MVX-II instruments can be powered from the Vtx2 (12 Vdc) terminals of the 1141.

RS485 +/- terminals for A02 are #14/#15, for A21 are #46/#47.

TTL Auxiliary Serial Port

When resource A02 or A22 is configured to support TTL communications, the following wiring diagram can be used to connect the Scanner 1141 to a 3V or 5V TTL communication device.

For TTL communications, Resource A02 uses connector CN33; resource A22 uses connector CN29. If these connectors are not present along the right edge of the mainboard, the TTL option is not installed. Eight-pin inline connectors and cable are available from Cameron. An 18” long cable with a connector on each end is part number 0027-9029T.

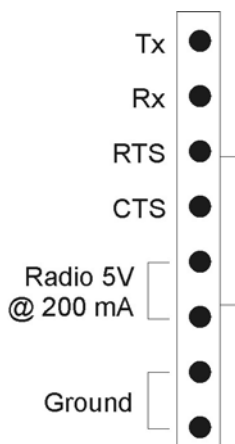


Figure 3.29—Wiring diagram for connecting auxiliary serial port A02 or A22 directly to a device using a TTL 8-pin connector

Chapter 4: Startup and Configuration

Startup Procedure



WARNING

WARNING – EXPLOSION HAZARD

ENSURE THAT THE AREA IS NON-HAZARDOUS BEFORE CONNECTING A PC TO A SERIAL PORT, OPENING THE ENCLOSURE OR ADDING OR REMOVING ANY WIRES.

1. Ensure that the “Backup Batt” jumper (CN20) is positioned across the “ON” or upper pins. See [Backup Batt \(CN20\)](#), page [33](#), for details.
2. Ensure that the “RAM Size” Jumper (CN10) is positioned in the desired location. “High” is 96 kbytes, “Low” is 64 kbytes. See [RAM Size \(CN11\)](#), page [36](#), for details.
3. Ensure that power is connected to terminals 2 (+) and 3 (-) on the main circuit board.
4. If a battery is used, ensure that it is connected to terminals 4 (+) and 5 (-).
5. Turn the power switch (SW9) on.
6. Ensure that the correct firmware version is installed in the Scanner. The firmware version can be viewed from the ScanWin user interface or by turning on the *Power* switch (SW9) and watching the local display until it scrolls to the firmware version. The typical firmware version will be NFLo or IGas X4.3.4G or higher, where X identifies firmware options such as M for Modubs or P for ScanPLC. If the firmware needs to be updated, follow the procedure in Appendix D, *Flashing the Scanner*.
7. Perform a superbboot (see the procedure below) and continue to set up the Scanner using the setup steps on page [57](#).

Superbooting the Scanner

After power has been applied to the Scanner for the first time, a superbboot is recommended for initializing the memory.

Note: If the Scanner has been *FLASHED* with the desired version of firmware or is *NOT CONFIGURED*, perform a *superboot*. If it is already configured, it is not necessary to perform a superbboot. If a previous configuration was saved, the configuration can be restored after a superbboot is performed.

Note: Superbooting **ERASES** all configuration and history data. **SAVE** all configuration and history data before superbbooting the Scanner RTU. See the ScanWin manual for instructions on saving configuration data.

To perform a *superboot*, use the following procedure. (Refer to Figure 4.1 for switch locations.)

1. Set the **Power** switch (SW9) to **OFF**. The switch is located in the top left corner of the main board.
2. If the main board contains a **Configuration Lock** switch, ensure that the switch (SW11) is UNLOCKED. The position of this switch is not detectable via observation alone, but can be verified from the System screen of ScanWin. If the Configuration Lock is in an unlocked position, the CFG Lockout Status field will be marked with an “X”; if it is in a locked position, the field will be marked with a checkmark. (See [Config Lock \(SW11\)](#), page 31, for more information on the *Configuration Lock* switch.)
3. Locate the Super Boot button on the left of the main board.

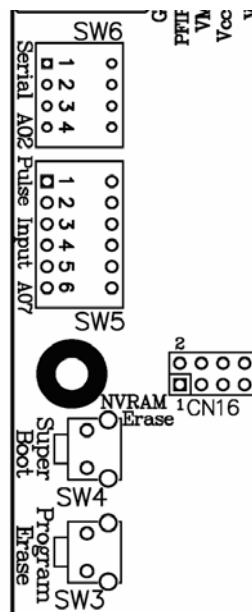


Figure 4.1—Super Boot button

4. Press and hold the **Super Boot** button, and without releasing it, move the **Power** switch (SW9) to the **ON** position and continue holding the Super Boot button in for approximately 10 seconds. In about 1 minute, the super boot process will be completed and the display will show the following message:

```
Superboot found
resetting unit
**REMINDER**
be sure to setup
unit for
non-superboot
```

It is safe to release the **SuperBoot** button when this message appears.

Note: If the SuperBoot button is released before 10 seconds, the superboot may be incomplete, and the unit **may not** function properly.



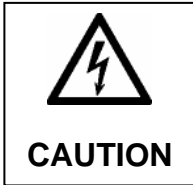
CAUTION

CAUTION
SUPERBOOTING ERASES ALL CONFIGURATION AND HISTORY DATA. SAVE ALL CONFIGURATION AND HISTORY DATA **BEFORE** SUPERBOOTING THE SCANNER RTU.

Setup Steps

1. Start ScanWin and set the time and date at the prompt. (See the ScanWin manual for instructions.)
2. If it is necessary to add new hardware to the Scanner RTU, perform the following steps:
 - a. Disconnect or switch off the input power to the Scanner (SW9).
 - b. Connect the transmitters, RTDs and other end devices.
 - c. If the end devices include turbine meters or other pulse output meters connected to A07 and A14, ensure that SW5 and SW1 are set to the appropriate mode.
 - d. When all end devices have been connected, turn on input power to the Scanner (SW9).

3. Configure the scanner as described in the ScanWin manual (*Chapter 2, Overview of the Startup Procedure*).



CAUTION

IT IS RECOMMENDED THAT THE NEW SCANNER CONFIGURATION BE REBUILT IN ITS ENTIRETY. PROBLEMS MAY RESULT WHEN A CONFIGURATION FILE BUILT IN ONE FIRMWARE VERSION IS UPLOADED TO ANOTHER SCANNER WITH A DIFFERENT FIRMWARE VERSION.

4. In applications where the *Configuration Lock* switch (SW11) is legally required, enable the switch and seal it (see [Config Lock \(SW11\)](#), page 31).

MVT Calibration

Local installation effects such as instrument positioning, tubing and site elevation require local calibration of both the differential pressure and the static pressure to obtain custody transfer quality accuracy. It is recommended that the differential pressure and static pressure be verified upon installation and recalibrated if required.

For initial installation of the MVT sensor it is possible to perform a local atmospheric zero calibration of the static pressure. However it is recommended to perform a full static and differential pressure calibration using a select number of calibration points.

Chapter 5: Troubleshooting

This section describes a basic procedure for locating Scanner 1141 Hardware operating problems. It is not intended to solve all problems for all users, but rather is provided to assist users in the field with the most commonly encountered problems. If a problem not covered by this guide is encountered, contact any of the following:

- In Canada, (877) 805-7226 (Scanner Help Desk) or (403) 291-4814
- In the US, (800) 654-3760
- In the UK, 44-1243-826741

Tools Required

As a minimum requirement for troubleshooting and performing minor maintenance on the Scanner 1141, the following tools should be available to the user:

- Laptop PC and ScanWin software version 3.0.0 or higher
- Scanner cable (10-ft cable: CS08-338-01; 50-ft cable: CS08-338-50)
- Digital multimeter that can measure 0.0-25.0 VDC and 0.0-2,000.0 mA
- Large slotted screwdriver
- Instrument-size slotted screwdriver
- Phillips #2 screwdriver

Problems and Solutions

Table 5.1—Problems and Solutions	
Problem	Possible Solutions
<p>A) The Scanner is not operating at all.</p> <div style="border: 1px solid black; background-color: yellow; padding: 5px; width: fit-content;"> <p>Refer to Transmitter Voltage, page 64, for more information.</p> </div>	<ol style="list-style-type: none"> 1. Press the Display Wakeup button to turn on the display. 2. Plug the console port cable into the local console port, and run ScanWin on your Laptop to communicate to the Scanner 1141. 3. Check battery voltage on the Scanner 1141's main battery located in the rear of the enclosure. The battery voltage must be: <ul style="list-style-type: none"> • above 6 VDC for 6-volt systems • above 11.2 VDC for 12-volt systems 4. If a Class I, Division 2 integral charge controller is used, check the Batt+ and Batt- terminals (terminals 4 and 5) on the main board and make sure the connections are secure. A power cable should be connected to the Power +/- terminals (terminals 2 and 3) on the main board. 5. Perform a restart by setting the Pwr switch SW9 to the OFF position, and then turning it ON again. Within 1 minute, the Scanner 1141 should display the message "Power on restart". 6. If Scanner is still not operating, set the Pwr switch SW9 to the OFF position. Disconnect the Power+ and Battery+ terminals for 30 seconds, ensuring that the ends of the disconnected wires do not contact anything. Set Pwr switch SW9 to the ON position. Within 1 minute, the Scanner 1141 should display the message "Power on restart".
<p>B) The Scanner display will not "power up".</p>	<ol style="list-style-type: none"> 1. Press the Display Wakeup button. 2. Adjust the "Contrast" potentiometer in the upper left part of the mainboard. With a small slotted screwdriver, rotate the control clockwise to increase the contrast to the point where all of the display pixels are blackened out. If this works, turn the contrast back to the desired setting. 3. See problem A: "The Scanner does not seem to be operating at all."
<p>C) The Scanner will not talk to ScanWin.</p>	<ol style="list-style-type: none"> 1. Ensure that the console port cable is plugged into the Scanner 1141, and the correct COM Port is displayed on your laptop. 2. Check communications settings to ensure that they match those of the Scanner 1141. If you are unsure of the Scanner's settings, turn the Pwr switch SW9 off and then on again. When the Scanner 1141 boots up, the display will reveal the firmware version (e.g. NFlo M4.3.3G) followed by the local console port settings (e.g. 9600, 8, N, 1). In the example given, assuming the console port cable is plugged into COM Port 1 of the PC, the default values for communication are as follows: ScanWin is used for version 4 firmware (e.g. NFlo M4.3.3G). Local console communication settings are found in the main menu Tools>Communication setup. Family and Scanner name are _DIRECT_, with default settings as follows: <ul style="list-style-type: none"> • Port group is DIRECT. • Baud rate is 9600. • Stop bits is 1. • Parity is none.

Table 5.1—Problems and Solutions

<i>Problem</i>	<i>Possible Solutions</i>
<p>C) The Scanner will not talk to ScanWin (cont'd).</p>	<p>Ports Tab default settings are:</p> <ul style="list-style-type: none"> • Port is COM1. • Status is enabled. • Port Group Name and Device setup name are DIRECT. <p>3. Check to ensure that the cable inside the Scanner 1141 enclosure that connects the local console connector to the CN34 A01 connector on the main board is properly connected at both ends.</p>
<p>D) The Scanner battery does not hold a charge.</p> <div style="border: 1px solid black; background-color: yellow; padding: 5px; margin-top: 10px;"> <p>For instructions on replacing the battery, see Page 66.</p> </div>	<p>1. Check the charging voltage coming into the 1141. Power should be connected to the Power +/- terminals (terminals 2 and 3) on the 1141 main board. Also, check the power cable that runs from the power supply board to the CN35 connection labeled “Power” along the top right edge of the Scanner 1141 main board. This cable terminates with a 6-pin connector on the main board, as shown in Figure 2.13.</p> <p>If a 12-volt solar panel is being used, it should be 13-18 VDC. If a 24-VDC and I.S. barrier combination is being used, it should be 16-20 VDC. If a 12-VDC and I.S. barrier combination is being used, it should be 7-9 VDC.</p> <p>2. Check for a blown fuse in the factory-installed wire connecting the positive battery terminal to the mainboard. The 10-amp inline ceramic fast-blow fuse is ¼ x 1 ¼-in. ABC-10.</p> <p>3. Although the voltage seems sufficient, there may not be enough current to sustain the Scanner’s operation over a long period of time. If this is suspected, remove one of the input power leads coming from the charging device (e.g. solar panel). Using a current meter, measure the amount of current being supplied to the Scanner 1141 battery. A fully charged Scanner 1141 will only draw 10 to 20 mA. A low battery will draw as much as the solar panel will produce, up to 10 amps on the charger integral to the mainboard.</p> <p style="padding-left: 20px;">Typical Solar Panel Max Current</p> <ul style="list-style-type: none"> • 5 watt- 290 mA (0.29 A) • 10 watt- 580 mA (0.58 A) • 30 watt- 1,750 mA (1.75 A) <p>4. The Scanner 1141 battery may have been damaged due to a series of excessively deep discharge cycles (e.g. less than 5 VDC for the 6-volt system). This might be symptomatic of a large number of low battery alarms on the Scanner 1141 only at night when there is no sun, despite the fact that the system has seen a consistent amount of sunshine during the daylight hours. Some of the battery’s capacity may be restored by fully charging the battery and then discharging it to 5.5 VDC repeatedly in the shop. If not, the battery should be replaced.</p>

Table 5.1—Problems and Solutions

<i>Problem</i>	<i>Possible Solutions</i>
<p>E) The Network Port is not functioning.</p>	<ol style="list-style-type: none"> 1. Check to ensure that the network has been enabled and the network port communications settings are correct for your application. ScanWin network port settings are found on the System > Network tab. Status of network should be a green check mark to indicate the network is enabled. The Scanner EFM/RTU serial port settings can be viewed by clicking on the serial port Details button. While on the network screen, also check to ensure that the network port has not locked up. Typically, the “Network connected=” field will say “no” unless the host system is polling it at that instant. Seldom will the network remain active for more than a minute or two at a time. If “Network connected=yes” is displayed for a longer period, disable the network and re-enable it. 2. Check that the network port has been wired properly for your application. In the example above, resource A02 (RS-232) would require, at a minimum, transmit on terminal 9, receive on terminal 10, and ground on any of the commons (e.g. terminal 13 or 21). The other serial connections will depend on your specific application. Refer to the Scanner Support Group for further assistance. 3. Check that the serial port is operational by performing a loopback test. Refer to ScanWin System>Network or Hardware tabs in ScanWin for more information. 4. Normally, the serial port will be powered down so that there is no voltage between transmit and ground or receive and ground. After it has been “awakened,” the receive line (terminal 10) should be at -8 VDC with reference to ground except when data is being received, when it should toggle up and down briefly between +8V and -8V. If this is not the case, a hardware problem may exist.
<p>F) The MVT cell is not providing process signals to the flow run.</p>	<ol style="list-style-type: none"> 1. Check to ensure that the MVT hardware resource has been allocated to the flow run. With ScanWin, check the Flowrun > Live Inputs tab. 2. Check to see if the zero and full-scale values for the MVT have been read into the Scanner 1141 correctly. With ScanWin, check the Hardware tab. If the zero and full-scale values are reading “Invalid”, perform a software reset and return to the same display. Check the cables that connect the MVT to the SI interconnect board and the cables that connect the SI interconnect board to the Scanner. If the zero and full scale values still read “Invalid”, power down the Scanner 1141 and replace the MVT cell.

Transmitter Voltage

When the *Power* switch (SW9) is in the “down” position, the Scanner is off and the entire system is shut down. A time delay (~10 ms) is provided to allow the system to execute its power fail code before power is lost and the system is reset.

Switch settings must be correct and transmitter voltage must be correct for the type of transmitter being used. Check “Vtx” on the main circuit board terminals (refer to [Analog Inputs](#), page 42), For inputs that can be configured as RTD or analog inputs check the ScanWin System tab to confirm that the input is configured as desired. To change the input configuration go to ScanWin Setup > System Setup.

Test Voltages

See Tables 5.2 and 5.3 for voltage supplies generated in the Battery Charge Controller Circuit Board, and see Figure 5.1 for transmitter test points on the main circuit board. Voltage should be measured between the ground connector (“Gnd”) and the following test pins.



WARNING

WARNING – TO PREVENT DAMAGE TO THE CIRCUIT BOARD, DO NOT SHORT PINS TOGETHER.

Table 5.2 –Voltage Generated by Power Supplies

<i>Supply</i>	<i>Voltage</i>	<i>Description</i>
Vcc	5V ± 5%	Powers computer & interface circuitry.
VPP	0V	Flash memory programming supply, 5V when flashing RTU
VPR *	5V ± 5%	Output of switching regulator powers computer and supplies 3.3V regulators
VMSP	3.3V ± 3%	3.3V supply for the MSP430, even with power off
VCC5.5	5.5V ± 10%	Analog supply for A/D system, if Analog and/or RTD inputs are present
VBB	5V ± 5%	Powers NVRAM and real time clock, ~3V when not powered
VCC3	3.3V ± 3%	Powers 3.3 volt circuits including MVTs
VLCD	5V ± 5%	Power for LCD display, only when display is on.

* Class I, Div. 2 with integral 6V or 12V battery charge controller

Table 5.3 –Voltage Generated by Control Signals

<i>Signal</i>	<i>Voltage</i>	<i>Description</i>
IBKL*	0.95 to 2 V	Constant current control when the LCD backlight is on. 5V when backlight off
PFIBAT	> 1.23V	Power Fail detector for 6V battery systems, shuts down RTU when PFIBAT and PFIPWR are less than 1.23V.
RESETN	5V CMOS	System active low reset signal.
32KHZ	0-5V CMOS square wave	32.768 KHz real-time clock oscillator output
PFIPWR*	> 1.23V	Power Fail detector for 12V battery system, shuts down RTU when PFIPWR is less than 1.23V (i.e. when Power+ and Battery+ are below ~9V).
MSPRST	3.3V CMOS	MSP430 active low reset signal.

* Class I, Div. 2 with integral 6V or 12V battery charge controller

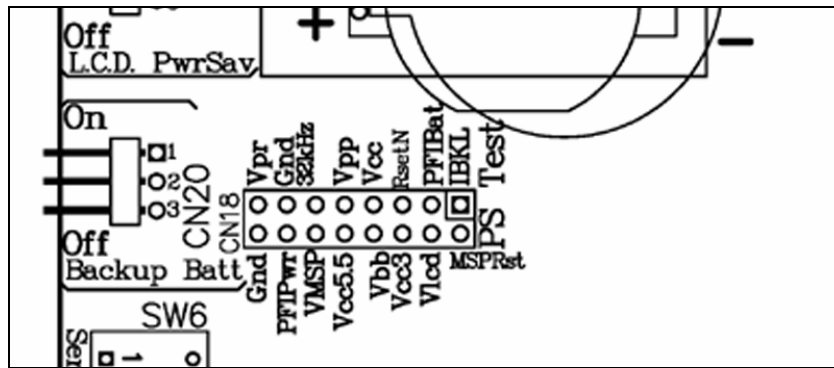


Figure 5.1—Transmitter test points on the 1141 main board

NVRAM Lithium Battery Voltage

The NVRAM lithium battery must register above 2.0 VDC when using ScanWin version 3.0.0 and higher with firmware version 4.3.5 and above. When measuring the NVRAM battery voltage with a voltmeter (this measurement can be performed with the battery in the holder while the Scanner is operating), the voltage will be 0.3 to 0.7 volts higher than when it is measured by the firmware. The value read by the Scanner firmware is the actual (backup) voltage applied to the NVRAM and PIC (for operation as an RTC) and includes the voltage drops from the Schottky diodes that are part of the non-incendive circuit.

Note that with lithium batteries, the voltage drops off dramatically so there is never much of a “low voltage” warning. A NVRAM battery voltage above 2.0 VDC indicates the configuration is still backed up; a voltage of zero means that the battery is dead, not installed, or the jumper is missing.

NVRAM Battery Change Procedure

The following steps outline the procedure for changing the NVRAM / lithium backup battery in the Scanner 1141. The battery will last between 7 and 10 years under normal usage.

1. Use ScanWin to download all configuration, calibration and historical data from the Scanner RTU.
2. Turn off the Scanner 1141 RTU by moving the *Power* switch (SW9) to the “down” or OFF position.
3. Disconnect the power supply to the Scanner 1141.
4. Lift the clip that holds the lithium backup button cell battery in the upper left-hand corner of the board and remove the battery. Replace it with a 3.6V lithium button cell battery, noting the correct polarity.
5. After ensuring that all connections have been made, restore power to the unit following the startup procedure on page 55.
6. Restore the configuration to the unit with ScanWin.

7. Check the voltage of the new lithium battery in ScanWin. Select the System tab at the top of the screen; then select the Node Information tab at the right side of the screen. Look for “NVRAM backup battery voltage.” The value displayed should be close to 3.6 volts.

Returning the Scanner to the Manufacturer

If the Scanner 1141 RTU must be returned to Cameron’s Measurement Systems Division, ship it as a complete unit, but remove the sealed lead acid battery from the Scanner enclosure. There is usually no need to return the battery.

If it is not possible to return the complete unit, return the main circuit board. The main circuit board is removed by undoing the six screws or standoffs that connect it to the base plate. NOTE: Circuit boards should be shipped in antistatic bags, and a well-protected package.

Replacing the Sealed Lead Acid Battery

A label mounted inside the enclosure lists batteries certified for use with the Scanner 1141 (Figure 5.3). An operator can determine which batteries are suitable for his Scanner 1141 by identifying batteries with the proper voltage and temperature range, or by examining the order code in the Code field of the data plate attached to the Scanner 1141. The order code for the battery is the first two-digit number following the Scanner 1141 model. For example: if the code listed on the data plate is 1141L-XX-YY-YY... , “XX” is the battery order code required for replacement.

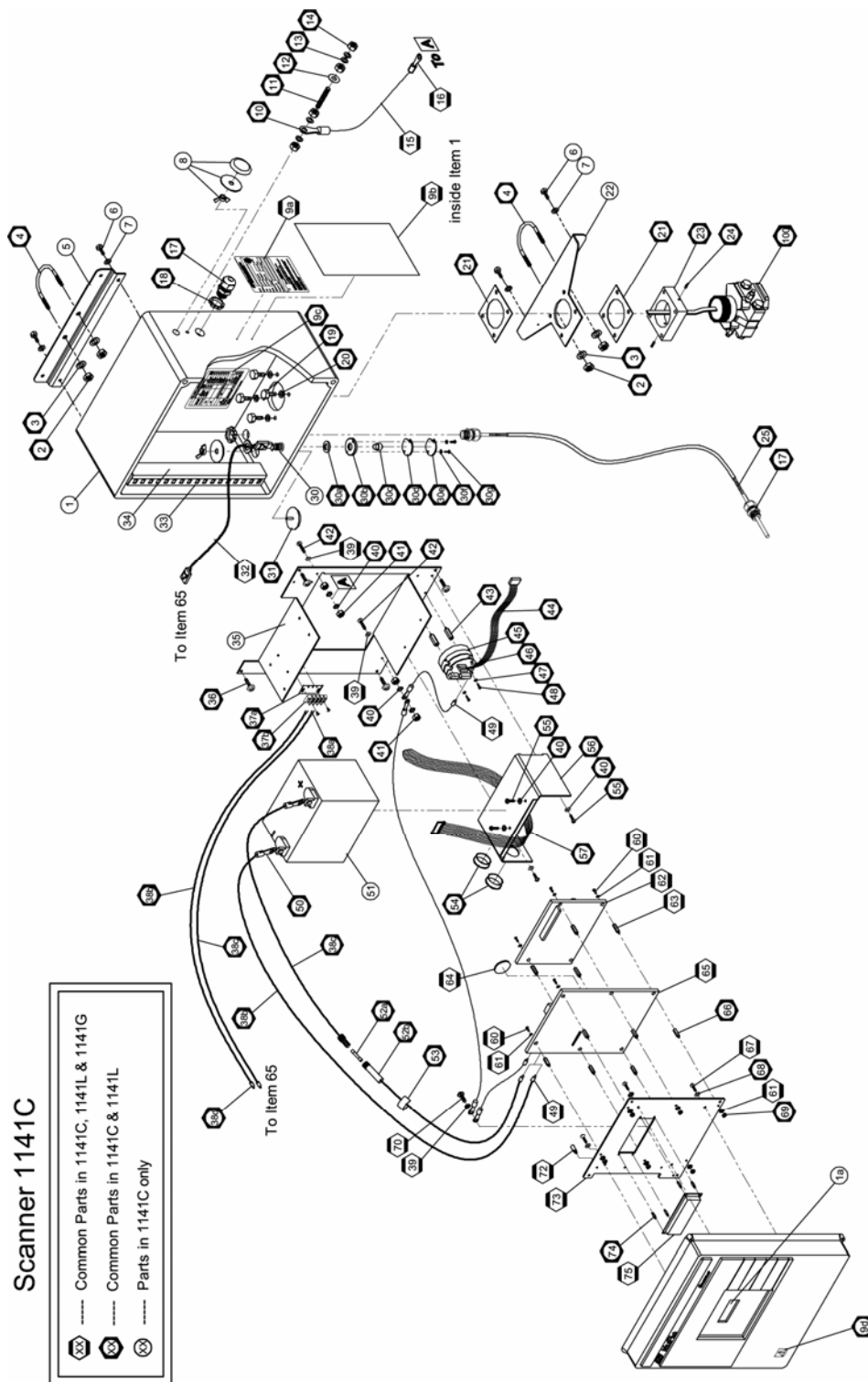
1141 Sealed Lead Acid Batteries				
Maximum Ambient Temperature: 40°C				
	6V	order code	12V	order code
Panasonic	LC-R0612P	61	LC-R1233P	32
Powersonic	ps-6360	63	ps-12330	32
	ps-6580*	65	ps-12550*	55
TopIn			TP 12-33	32
			TP 12-55*	55
SBS			G-12330	32
			G-12550*	55
Maximum Ambient Temperature: 60°C				
	6V		12V	
C&D Technologies			MPS 12-33	29
			MPS 12-50*	50
EaglePicher	CF-6V58FR-S9*	66	CF-12V29FR-S10	29

*: 1141C only
See Data Plate for Max. Ambient Temperature

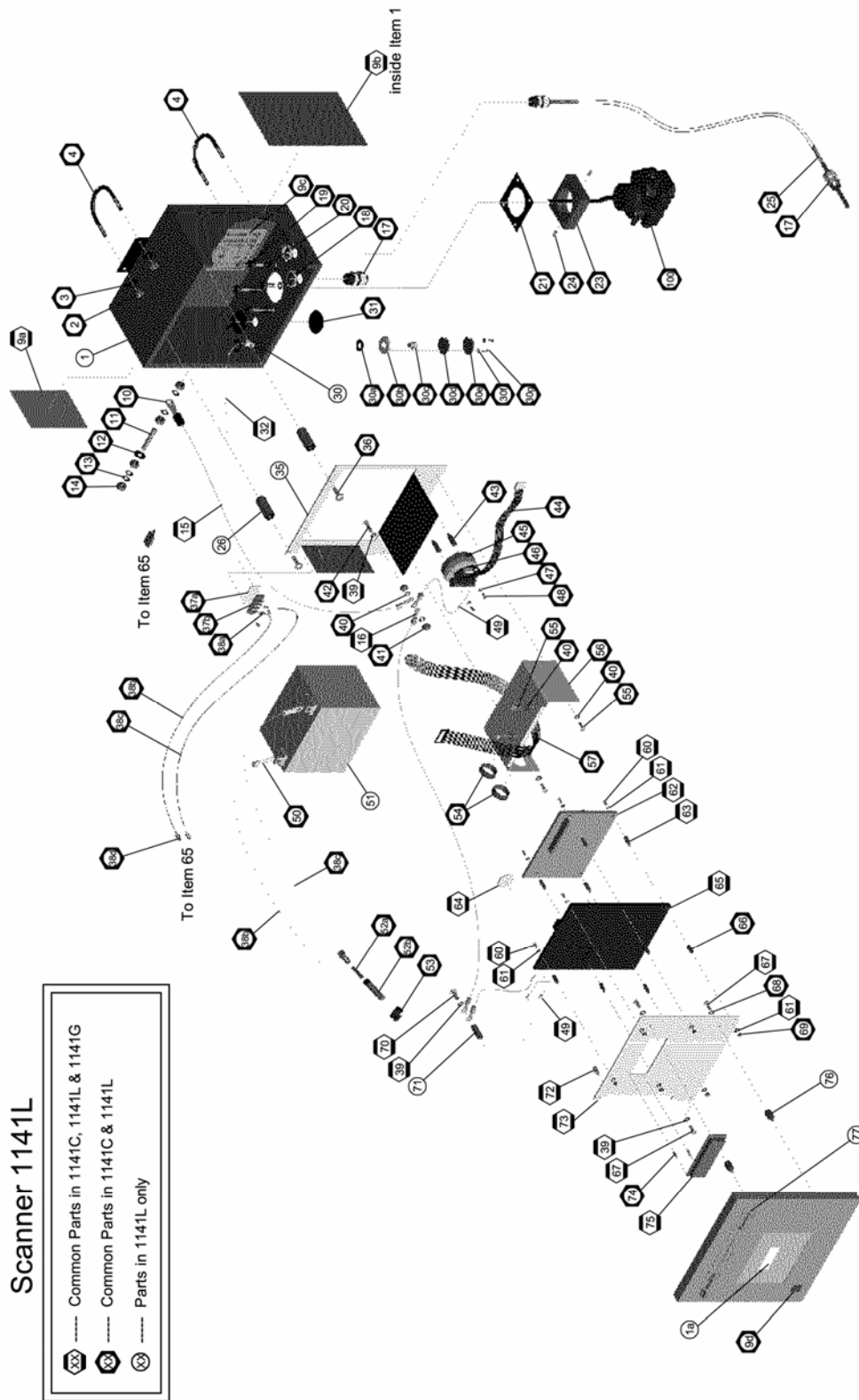
Figure 5.3—Battery label

Chapter 6: Parts List and Order Code

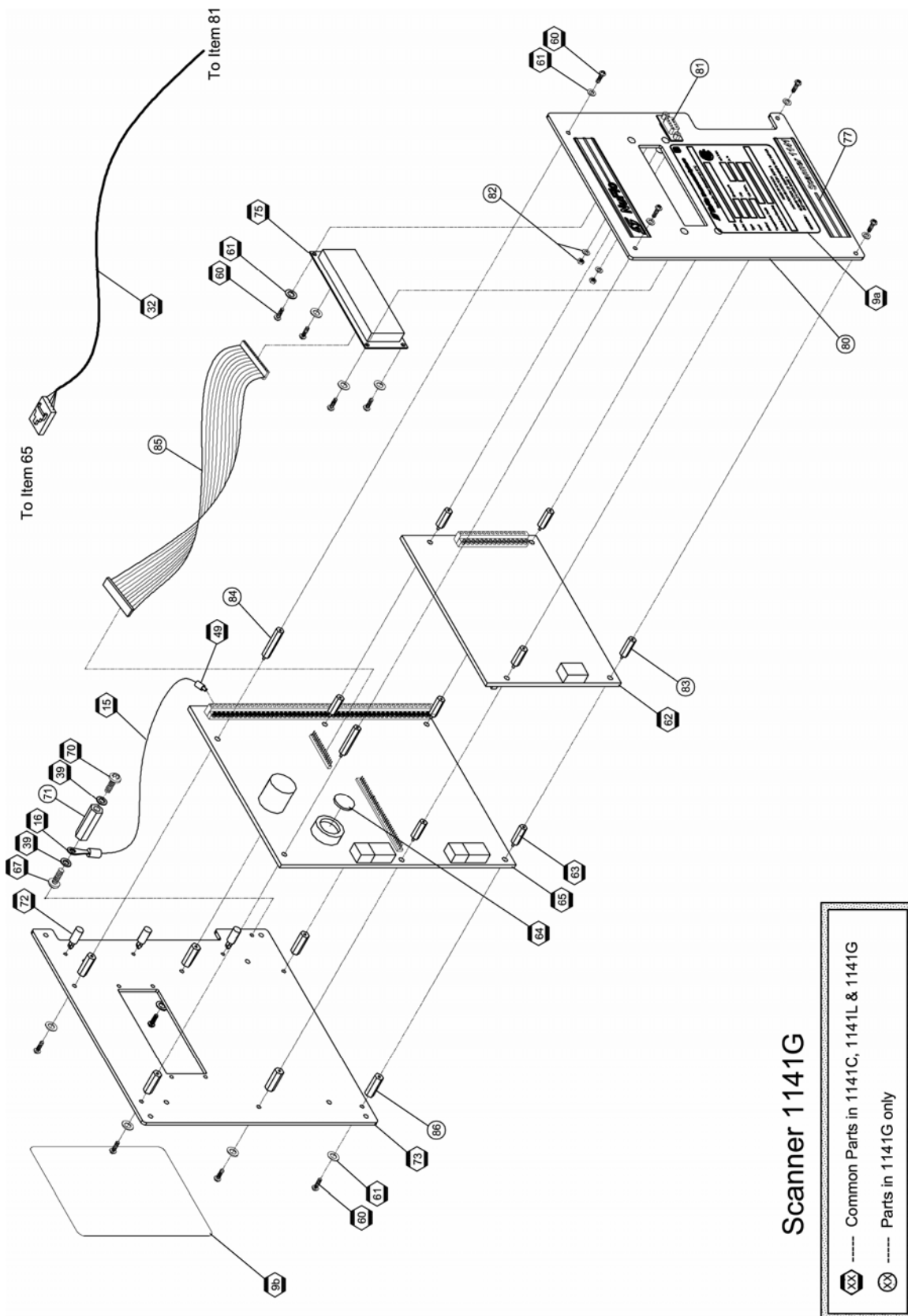
Scanner 1141C



Scanner 1141L



Scanner 1141G



Scanner 1141G

- Common Parts in 1141C, 1141L & 1141G
- Parts in 1141G only

Table 6.1—Parts List - Scanner 1141C, 1141L & 1141G

Item	Description	Part Number	Quantity per Unit		
			1141C	1141L	1141G
1	Enclosure Assembly with window				
	1141C	1141-1001B	1		
	1141L	1141-1002B		1	
1a	Lens, Screened - 2 X 16W (included in item 1)				
	1141C	1141-1017C-01	1		
	1141L	1141-1017C-03		1	
2	Nut, Machine Screw 5/16-18		4	4	
	CS	0500-0033J			
	SS	CS01-442-404			
3	Lockwasher, 5/16-18		4	4	
	CS	0003-0006K			
	SS	0003-0083K			
4	U-bolt, 5/16"-18, Bracket, Mounting		2	2	
	CS	0440-0001J			
	SS	CS01-442-402			
5	Bracket, Mounting, Upper Pole		1		
	CS C1008	1141-1010C-01			
	SS 316	1141-1010C-03			
6	Screw		2		
	Hex Hd 10-32 X 5/8 ST CP	0116-0005J			
	SS brackets use, Slot 10-32 X 5/8 SS	0119-0038J			
7	Washer, Flat, #10, SS	0003-0047K	2		
8	Hole Seal 3/4"	0192-1029T	1		
9a	Dataplate, Scanner CSA, Div.2	1141-1012G-01	1	1	1
9b	Label, Wiring Connections, 1141	1141-1007G	1	1	1
9c	Label, Battery, 1141	1141-1018G	1	1	
9d	Label, Warning Sign	1141-1019G	1	1	
10	Terminal Crimp, Ring Tongue 1/4 (14-16Awg)	0109-9015T	1	1	
11	Stud, 1/4-20 X 1-1/2 SS	0007-9007T	1	1	
12	Washer, Seal, 1/4", CS, Bonded Neoprene	0003-9008K	1	1	
13	Lockwasher, Internal Tooth - 1/4", SS	0003-1110K	4	4	
14	Nut, Machine Screw 1/4-20 18-8 SS	0500-0046J	4	4	
15	Wire, 14 AWG - Green	0012-9002T-11	As required	As required	As required
16	Terminal Crimp, Ring Tongue #8 (14-16Awg)	0109-9014T	5	5	1
17	Strain Relief, 1/2" NPT	0091-9000T	3	3	
18	Lockwasher & Gasket, NEMA 4 - 1/2"NPT	1140-1028J	2	2	

Table 6.1—Parts List - Scanner 1141C, 1141L & 1141G

Item	Description	Part Number	Quantity per Unit		
			1141C	1141L	1141G
19	Screw, Hex Cap Hd 1/4-28		4	4	
	CS	0210-9011J			
	SS	99002004			
20	Lockwasher, Split - 1/4" , CS CP	0003-0013K	4	4	
21	Gasket, MVT Mounting Flange	90023001	2	1	
22	Bracket, Mounting, Lower Pole		1		
	CS C1008	1141-1011C-01			
	SS 316	1141-1011C-03			
23	Flange		1	1	
	MVT Mounting, Aluminum	30174001			
	MVT Mounting, SS	101295880			
	Aluminum Mounting, 1/2" NPT,	1141-1014-01			
	SS Mounting, 1/2" NPT, 316	1141-1014-03			
24	Screw, Hex Soc Set, 8-32 X 3/8 SS	0320-1007J	2	2	
25*	RTD Probe/Armored Sheath, 4 Wire		1	1	
	10 Foot	1100-1010C-10			
	30 Foot	1100-1010C-30			
26	Stand-off, FXF 10-32 X 3/4", AL	0152-9015T		4	
30*	Connector, Console Port				
	1141C	1140-1054B	1		
	1141L	0109-1310T		1	
30a	Gasket, Console Port Connector, Silicone	1140-1031R	1	1	
30b	Base, Console Port Connector	1100-1011C	1	1	
30c	Cap, Sealing, Console Port Connector	0090-9001T	1	1	
30d	Gasket, Console Port Connector	1100-1013R	1	1	
30e	Cover, Console Port Connector	1100-1012C	1	1	
30f	Washer		2	2	
30g	Screw		2	2	
31	Hole Seal 3/4"	0192-1029T	1	1	
32*	Cable, Connector, Std	1140-1053B-11	1	1	0.5
33	Duct, Wiring - 1"W X 1"H X 6'L PVC LG	0027-9003T	As required		
34	Cover, Duct, Plastic Wiring, Grey 1"	0027-9009T	As required		
35	Mounting Plate				
	1141C	1141-1003C	1		
	1141L	1141-1004C		1	

Table 6.1—Parts List - Scanner 1141C, 1141L & 1141G

Item	Description	Part Number	Quantity per Unit		
			1141C	1141L	1141G
36	Screw, Pan Phill HD 10-32 X 3/8 SS	0111-0057J	4	4	
37a	Insulating Marker Strip, 3 Double Terminal	3900-7100T	1	1	
37b	Terminal Block, 3 Double Terminal - Phen	3900-7000T	1	1	
38a	Terminal, Flanged Spade - Size 6 Blue	0062-9007T	2	2	
38b	Wire, Stranded 14 AWG - Black	0012-9002V-03	As required	As required	
38c	Wire, Stranded 14 AWG - red	0012-9002V-09	As required	As required	
38d	Wire Tip Ferrule, Blue H2.5/14	1130-4666T	2	2	
39	Lockwasher, External Tooth - #8, SS	0003-9004K	3	3	2
40	Lockwasher, Internal Tooth - #8, SS	0003-0066K	10	8	
41	Nut, Machine Screw 8-32 18-8 SS	0500-0047J	4	2	
42	Screw, Pan Ph Hd, 8-32 X 3/4 18-8 SS	0119-9002J	2	1	
43	Stand - off, M X F 6-32 X 1-1/2" - Aluminum	0152-9004T	2	2	
44*	SI Cable, Flat, Assy, Ribbon 20 Cond, 26"	1141-1009C	1	1	
45*	SI Board (included with MVT)	99160000A	1	1	
46*	SI Interconnect Board	30160002A	1	1	
47	Lockwasher, Internal Tooth - #6, SS	0003-0070K	2	2	
48	Screw, Ph,Pn Hd, 6-32 X 1/4, SS	0119-1013J	2	2	
49	Wire Tip Ferrule, Blue H2.5/14	1130-4666T	4	4	1
50	Terminal, Ring-type - Size 16 Blue	0109-9006T	2	2	
51*	Battery		1		
	32 Ah	0130-9022T		1	
	55 Ah	0130-9024T			
52a*	Fuse, 10A Fast Blow 1/4" X 1-1/4" Ceramic	0111-9019T	1	1	
52b*	Fuse Holder , 18" Red Wire 14 AWG	0111-9020T	1	1	
53	Label fuse 10 Amp		1	1	
54	Grommet Round Bushing, Dia.1.375"	99065003	2	2	
55	Screw, Bd Ph Hd 8-32 X 3/8 18-8 SS	0119-9001J	6	6	
56	Bracket, Mounting, Battery Stand	1141-1005C	1	1	
57	Velcro Strap, 100 cm Length	0022-9001T-10	1	1	
60	Screw, Ph,Pn Hd, 6-32 X 1/4, SS	0119-1013J	6	6	14
61	Lockwasher, Internal Tooth - #6, SS	0003-0070K	12	12	14
62*	Board, EXP.		1	1	1
	MIO2, MVT SERIAL PORT ONLY	1141-0210B-10			
	MIO2, MVT , P/I, A/O, 2 DIO	1141-0210B-26			
63	Standoff, , MXF, 6-32 X 7/16"	0152-9018T	4	4	4
64*	Battery, Lithium coin, 3V, CR2032	0130-9029T	1	1	1

Table 6.1—Parts List - Scanner 1141C, 1141L & 1141G

Item	Description	Part Number	Quantity per Unit		
			1141C	1141L	1141G
65*	Mainboard		1	1	1
	1141 Module - Full Load	1141-0301B			
	1141 Module - Medium Load	1141-0304B			
	1141 Module - Base Load	1141-0302B			
66	Stand - off, M X F 6-32 X 3/8" - Aluminum	0152-9007T	6	6	
67	Screw, Bd Ph Hd 8-32 X 3/8 18-8 SS	0119-9001J	4	5	1
68	Lockwasher, Internal Tooth - #8, SS	0003-0066K	4	4	
69	Nut, Machine Screw 6-32 SST	0500-0021J	6	6	
70	Screw, Ph Bd Hd 8-32 X 1/4 - Green Head	0119-9004J	1	1	1
71	Stand-off, FXF, 8-32 X 3/4" (3/8"HEX-AL)	0152-9002T		1	1
72	Stand-off, Snap X Post X 5/16", Plastic	1141-1016T	3	3	3
73	Mounting Plate, Mainboard, 2X16 Display	1141-1000C	1	1	1
74	Stand - off, Snap X Snap X 2mm, Plastic	1141-1015T	4	4	
75*	Display		1	1	1
	LCD 2 X 16	1141-0400C			
	Backlit LCD 2 X 16	1141-0401C			
76	Stand-off, MXF 6-32 X 1/4" - Al	0152-0036T		4	
77	Decal, Scanner 1141	1141-1006C		1	1
80	Mounting Plate, Top, 1141G, 2 X 16 Display	1141-1008C			1
81	DB9, Female solder Body	CS08-338-113			1
82	Stand-off, M X F 4-40 X3/16 Lg, Al Kit	CS08-607-114			2
83	Stand-off, MXF 6-32 X 1/2" - Al	0152-1111T			4
84	Stand-off, MXF 6-32 X 1" - Al	0152-9020T			2
85*	Cable Assy, Ribbon 16 Cond. 6" Lg	0027-9027T-1606			1
86	Stand-off, FXF 6-32 X 3/8" AL	0152-1100T			6
none	Power supply, 24 vdc @1 Amp, CSA Div2,	1000-1062T			
none	Cable, 8 pin 1141 TTL, 18" long	0027-9029T			
100*	Multivariable Transducer (MVT) Standard		1	1	
	MVT,100PSIA,30IN H20	55168006			
	MVT,300PSIA,200IN H20	55168001			
	MVT,300PSIA,840IN H20	55168003			
	MVT,500PSIA,200IN H20	55168007			
	MVT,1500PSIA,200IN H20	55168002			

Table 6.1—Parts List - Scanner 1141C, 1141L & 1141G

Item	Description	Part Number	Quantity per Unit		
			1141C	1141L	1141G
	MVT,1500PSIA,300IN H2O	55168005			
	MVT,1500PSIA,400IN H2O	55168008			
	MVT,1500PSIA,840IN H2O	55168004			
	MVT,3000PSIA,200IN H2O	55168045			
	MVT,3000PSIA,300IN H2O	55168046			
	MVT,3000PSIA,400IN H2O	55168047			
	MVT,3000PSIA,840IN H2O	55168048			
	MVT,5300PSIA,200IN H2O	55168049			
	MVT,5300PSIA,300IN H2O	55168050			
	MVT,5300PSIA,400IN H2O	55168051			
	MVT,5300PSIA,840IN H2O	55168052			
	Multivariable Transducer (MVT) NACE				
	MVT,100PSIA,30IN,H2O,NACE	55168016			
	MVT,300PSIA,200IN,H2O,NACE	55168011			
	MVT,300PSIA,840IN,H2O,NACE	55168013			
	MVT,500PSIA,200IN,H2O,NACE	55168017			
	MVT,1500PSIA,200IN,H2O,NACE	55168012			
	MVT,1500PSIA,300IN,H2O,NACE	55168015			
	MVT,1500PSIA,400IN,H2O,NACE	55168018			
	MVT,1500PSIA,840IN,H2O,NACE	55168014			
	MVT,3000PSIA,200IN,H2O,NACE	55168077			
	MVT,3000PSIA,300IN,H2O,NACE	55168078			
	MVT,3000PSIA,400IN,H2O,NACE	55168079			
	MVT,3000PSIA,840IN,H2O,NACE	55168080			
	MVT,5300PSIA,200IN,H2O,NACE	55168081			
	MVT,5300PSIA,300IN,H2O,NACE	55168082			
	MVT,5300PSIA,400IN,H2O,NACE	55168083			
	MVT,5300PSIA,840IN,H2O,NACE	55168084			
	Multivariable Transducer (MVT) SS BOLTING				
	MVT,300PSIA,200IN,H2O,SS BOLTING	55168035			
	MVT,1500PSIA,200IN,H2,SS BOLTING	55168036			

* Indicate recommended spare parts



1141 SCANNER MEASUREMENT RTU

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BASE UNIT:

Communication Connection: External Console Port	→	1141C [With Communications] NEMA 4 FRP
Communication Connection: External Console Port	→	1141L NEMA 3R Steel Enclosure
Communication Connection: DB9	→	1141G [OEM] Surface Mount Chassis

Shaded selections indicate stocked items

1141 Code Example: 1141C 55 30 D2 FL 83 00 2C IM R1 00 C2

1 POWER SUPPLY / BATTERY

No Battery (only selection for 1141G) (60 C assembly)	00
Division 2: 6 / 12 vdc charge controller, Integral to mainboard, (1141C & 1141L)	
Battery ready (Battery not included)	30
12 vdc - 29 to 33 Ah battery (60C assembly)	29
12 vdc - 32 Ah battery	32
12 vdc - 50 Ah battery (1141C only) (60C assembly)	50
12 vdc - 55 Ah battery (1141C only)	55
6 vdc - 12 Ah battery	61
6 vdc - 33 Ah battery	63
6 vdc - 58 Ah battery (1141C only)	65
6 vdc - 58 Ah battery (1141C only) (60 C assembly)	66

NOTE: 1a. Ambient temperature is -40 to +40C unless otherwise noted
 1b. Larger Enclosure/battery available with special acceptance approval.

2 SOLAR PANEL

Watts	Bracket	Cable	Approval	
None	None	None	n/a	00
10	Adj.	10'	Div 2	10
20	Adj.	10'	Div 2	20
30	Adj.	10'	Div 2	30
50	Vertical	10'	Div 2	50
80	Vertical	None	Div 2	80

NOTE: 2a. All brackets are for 2" pipe
 2b. For non standard solar panels please consult factory

3 DISPLAY

None [applicable to all models]
 2 lines X 16 character LCD Display
 2 lines X 16 character, Backlit LCD Display

00
 D2
 B2

4 INPUT OPTIONS (MAIN BOARD)

A02 Serial Port	Analog Input	RTD (Analog) Input	Pulse Input	Analog Output	Discrete I/O	Charge Controller	Notes 4.X	Transmitter Supply	
Hazardous Location Division 2									
RS232 /TTL	0	0	0	0	2	10 A	1	CL & 12VL	B1
RS232 /TTL	2	1(2)*	1	1	4	10 A		CL & 12VL	M1
RS232/ 485/ TTL	2	2(4)*	2	1	4	10 A Dual Stage	1, 2	CL & 12V Stepup	FL

NOTE: 4.1 Mainboard has a backlit capability.
 4.2 Mainboard has configuration lock switch (Measurement Canada).

5 PROGRAM

IGas (ISO Gas Calcs)
 NFlo 4 (Gas/Liquids- Hourly Data)

M-Modbus	P-PLC
59	P4
83	

NOTE: For other available programs, see PROGRAM LIST document 1100-1002B.

ADD →



1141 SCANNER MEASUREMENT RTU

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1141 Code Example: 1141C 55 30 02 FL 83 00 2C IM R1 00 C2

6 EXPANSION BOARD

None
 MIO2: Multiple Input/Output Expansion Board

MVT Port	Serial	Pulse In	Analog Out	Digital I/O
1		0	0	0
1		1	1	2

NOTE: MIO2 boards are like MIO1 except they incorporate terminals strips on the board rather than using the mainboard.

00
10
26

7 MOUNTING

Pipe Mount Universal (CS), with 2" U-Bolt
 Pipe Mount Universal (SS), with 2" U-Bolt, Enclosure 4X (1141C only)
 Wall / Panel Mount

NOTE: 7a. 1141G must use option code WL - Wall / Panel Mount
 7b. 1141L must use option code 2C or WL

2C
2S
WL

8 TRANSDUCER

No Transducer
 Integral Mounted MVT Transducer - other than shown (Specify as a separate line item) **Division 2 only**

Static psi	Differential Inch wc	Order Code	
		Standard	NACE
100	30	01	N1
300	200	03	N3
	840	08	N8
500	200	05	N5
	200	12	M2
1500	400	14	M4
	840	18	M8
	200	32	L2
3000	400	34	L4
	840	38	L8
	200	52	K2
5300	400	54	K4
	840	58	K8

Integral Mounted Pressure Transducer (require special acceptance)

Pressure only Transducer	Static (psi)	Code
Referenced to atmosphere	100	P1
	200	P2
	300	P3
Sealed Gauge	500	P5
	1000	P6
	1500	P7
	3000	P8
	5000	P9

NOTE: 8a. Integral mounted transducers are not available for the 1141G
 8b. Pressure transducers indicated are not custody transfer (MC) approved.
 8c. Use IM or PT codes when multiple transducers are mounted on unit.
 * Ranges also stocked in Houston

00
IM
99

9 RTD (Armored 4 wire 100 Ohm Platinum)

None
 10 foot
 30 foot

NOTE: 9a. For non-standard lengths, please consult factory

R0
R1
R3

10 COMMUNICATIONS INTERFACE - For Division 2 Approved configurations

NONE
 NOTE: THIS FIELD [10] IS ONLY APPLICABLE TO MODELS 1141C & 1141L
 Integral communication devices require special acceptance
 Special, specify as a separate line item

00
SP

11 APPROVALS

None
 CSA, Division 2
 Measurement Canada (MC) - Configuration Lock Seal, Division 2
 ATEX / CE, Zone 2 (pending)*
 * Battery may not exceed 33 Ah

00
C2
M2
A2

Appendix A: Specifications

General Specifications

Environmental

CSA Certification	Class I, Division 2, Groups A, B, C & D
Operating Temperature	-40°C to +40°C (-40°F to +104°F) with standard SLA battery -40°C to +60°C (-40°F to +140°F) with high-temperature SLA battery Any accessory or option not rated for +70°C (+158°F) or higher will require the 1141 assembly to be derated by 10°C (18°F) degrees below the rated temperature of the component.
Relative Humidity	0% to 95% Non-condensing

Enclosures

1141C (NEMA 4 or optional 4X)	Fiberglass-reinforced plastic
	Dimensions: 8 1/3" deep x 14 1/2" wide x 16 1/2" high
	Supports integral battery
1141L (NEMA 3)	Painted steel
	Dimensions: 8" deep x 12" wide x 12" high
	Supports integral battery
1141G	Chassis for mounting in other enclosures or cabinets
	Dimensions: 10.1" x 9.6" x 2.5"

Computer

CPU Speed:	7 MHz
Real-time Clock:	Time clock/calendar with battery backup
Program Memory:	Up to 768 Kbytes FLASH ROM memory

New application programs (firmware) can be loaded to the FLASH ROM using the WinsLoad or ScanFLASH utility program on a Microsoft Windows-compatible PC. RAM is available for operating system and intermediate calculations and NVRAM stores configuration, flow history, alarm, event logs and concurrent operations.

RAM size is jumper-selected to be either 64 or 96 Kbytes. NVRAM is what remains of the 256 Kbytes of memory after RAM is selected. (Refer to [RAM Size \(CN11\)](#), page 36 for details.)

Memory Options	CN11	RAM	NVRAM
256 Kbytes	Low (L)	64 Kbytes	192 Kbytes
	High (H)	96 Kbytes	160 Kbytes

Memory Backup Battery: powers the clock and maintains the contents of the NVRAM during power outages.

- For Class I, Division 2 applications, a user-replaceable button cell lithium battery (CR2032) provides backup NVRAM for 1 year at 40°C, and 1.5 years at 20°C.

Manufacturer	Model (20 mm dia. X 3.2 mm thick)
Panasonic	CR2032 or BR2032
Duracell	DL2032
Energizer	CR2032 or BR2032
Toshiba	CR2032 or BR2032
Rayovac	CR2032
Saft	LM2032
Maxell	CR2032

Display

User-assignable data is displayed on an auto-scroll 2-line x 16 character LCD. The display can be activated by a push button on the mainboard, or it can be firmware-configured to always be enabled. Backlighting is available on some hardware configurations; the operator can turn the backlight off or turn the entire display off via jumper selection to conserve power.

The display contrast can be manually adjusted. Contrast is factory-set for optimized viewing.

Viewable LCD Area:	99 x 24 mm (3.9 x 0.9")
Character Size	4.84 mm wide x 9.66 mm high
Character Format	5 x 7 dots
Operating Temperature	-20°C to +70°C (-4°F to +158°F)
Storage Temperature	-40°C to +80°C (-40°F to +176°F)

Installation

1141C or 1141L: The 2x16 display is viewable on the outside of the weatherproof enclosure, and it connects to a female connector on the non-component side of the mainboard.

1141G: The 2x16 display connects to a male connector on the component side of the mainboard via a short ribbon cable.

System Board

The system board contains the central processing unit, FLASH EPROM memory, RAM, NVRAM, interface circuitry for the display, and up to four serial ports. Class I, Division 2 configurations also include a charge controller integral to the system board. This board provides analog I/O and status/pulse I/O to support up to two natural gas or liquid flow runs with proportional/integral control.

Connection of I/O to the system board is provided by up to 50 terminals with cage type screw termination blocks with integral test points. There are also connectors along the terminal edge of the system board for TTL communication and MVT interface.

Each mainboard has an RS-232C local console port (A01), an RS-485 serial port (A21), and an A02 serial port.

Class I, Division 2 configurations also feature an MVT/RTD serial interface. An MVT is a multi-variable transducer capable of reading both static pressure and differential pressure.

The RTD (analog) input supports up to two RTDs; each RTD can be firmware-configured as two analog inputs.

The following are standard configurations of the mainboard:

Hazardous Location, Class I, Division 2									
2nd Serial Port	Analog Input	RTD (Analog) Input	Pulse Input	Analog Output	Discrete I/O	Charge Controller	Transmitter Supply (see descriptions below)	Notes	Order Code
RS-232/TTL	0	0	0	0	2	10 A	CL & 12VL		B1
RS-232/TTL	2	1(2)*	1	1	4	10 A	CL & 12VL		M1
RS-232/RS-485/TTL	2	2(4)*	2	1	4	10 A Smart dual stage	CL & 12V Stepup	1, 2, 3	FL

Notes:

1. Mainboard includes a Configuration Lock switch (Measurement Canada), and display backlighting.
2. Analog inputs have sockets on the mainboard for inserting precision resistors for 4-20 mA inputs.
3. 6V system power - low cutoff is 5.6V. Without low cutoff option, cutoff is 6V.

(CL) Current Limited Transmitter Supply: Current limited output that is “powered” from the higher of the battery and power input voltages. Approximately 50 mA, on Vtx1.

(12VL) 12V, 30 mA Voltage Limited Transmitter Supply: Outputs the higher of the battery and power input voltages, less 0.25V to a maximum of 12V, on Vtx2.

(12V Stepup) 12V, 30 mA Stepup Transmitter Supply: Outputs 12V regardless of battery and power input voltages, recommended for 6V systems with 12V transmitters on Vtx2.

Communications Port

Quantity	1 to 4 serial ports
A01* (port 1)	RS-232C local console c/w TX, RX, and GND
A02* (port 2)	RS-232C, RS-485 or TTL, firmware configured
A21* (port 3)	RS-485 (H0 configuration also has RS-232C)
A22 (port 4)	MVT/RTD transducer input, serial TTL (Division 2)
Baud Rates	110, 150, 300, 600, 1200, 2400, 4800, 9600, or 19200 bps, firmware configured
Bits per Character	7 or 8, firmware configured
Stop Bits	1 or 2, firmware configured
Parity	even, odd, or none, firmware configured
RS-232C ports	TX, RX, RTS, CTS, GND (Flow control software or hardware)
CTS	OFF/ON
RTS Delay	Manually entered in milliseconds

Communications Port (cont'd)

RS-485 ports	RS-485 is a two-wire, AC-coupled connection that uses dedicated terminals that are separate from the RS-232C, with switch-selectable biasing and termination resistors.
TTL ports	The TTL has an 8-pin molex connector, with Tx (3.3V), Rx (3.3V or 5V), RTS, CTS, GND, earth GND. Firmware-configurable for normal or inverted orientation.

*DMA (Direct Memory Access) on Rx and Tx of ports A01, A02, and A21.

MVT/RTD Input

The MVT/RTD Multivariable Transducer uses a serial TTL interface to transmit differential pressure, static pressure, and temperature to the Scanner EFM/RTU. This configuration can be used in Class I, Division 2 applications.

MVT Inputs

Quantity	2 (1 static pressure and 1 differential pressure)																										
Accuracy	Differential Pressure Accuracy (30 In. H2O): $\pm 0.10\%$ Differential Pressure Accuracy (200 to 840 In. H2O): $\pm 0.05\%$ Static Pressure Accuracy: $\pm 0.05\%$																										
Temperature Performance	$\pm 0.25\%$ of full scale over full operating temperature range																										
Effect on differential pressure for a 100-psi change in static pressure	Span shift $\pm 0.01\%$ of reading Zero shift listed by URL: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Differential Pressure URL (inches wc)</th> <th>Static Pressure URL (psi)</th> <th>Zero Shift (% of URL)</th> </tr> </thead> <tbody> <tr> <td>30</td> <td>100</td> <td>$\pm 0.05\%$</td> </tr> <tr> <td>200</td> <td>300</td> <td>$\pm 0.007\%$</td> </tr> <tr> <td>200</td> <td>500 to 5300</td> <td>$\pm 0.01\%$</td> </tr> <tr> <td>300</td> <td>1500 to 5300</td> <td>$\pm 0.004\%$</td> </tr> <tr> <td>400</td> <td>1500 to 5300</td> <td>$\pm 0.004\%$</td> </tr> <tr> <td>840</td> <td>300</td> <td>$\pm 0.002\%$</td> </tr> <tr> <td>840</td> <td>1500 to 5300</td> <td>$\pm 0.004\%$</td> </tr> </tbody> </table>			Differential Pressure URL (inches wc)	Static Pressure URL (psi)	Zero Shift (% of URL)	30	100	$\pm 0.05\%$	200	300	$\pm 0.007\%$	200	500 to 5300	$\pm 0.01\%$	300	1500 to 5300	$\pm 0.004\%$	400	1500 to 5300	$\pm 0.004\%$	840	300	$\pm 0.002\%$	840	1500 to 5300	$\pm 0.004\%$
Differential Pressure URL (inches wc)	Static Pressure URL (psi)	Zero Shift (% of URL)																									
30	100	$\pm 0.05\%$																									
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400	1500 to 5300	$\pm 0.004\%$																									
840	300	$\pm 0.002\%$																									
840	1500 to 5300	$\pm 0.004\%$																									
Stability	Long-term drift is less than $\pm 0.05\%$ of URL per year over a 5-year period.																										

MVT Inputs (cont'd)

Ranges available in standard and NACE	100 psia static pressure with differential pressure of 30" wc
	300 psia static pressure with differential pressure of 200 or 840" wc
	500 psia static pressure with differential pressure of 200" wc
	1500, 3000 or 5300 psia static pressure with differential pressure of 200, or 840" wc

Pressure Limits and Bolt Material					
Static Pressure Range (URL) ^a		Safe Working Pressure (SWP) ^b		Bolt Material	
PSIA	Mpa(a)	PSIA	Mpa(a)	Standard	NACE
100	0.7	450	3.1	B7 or 316 SS	B7M
300	2.1	450	3.1	B7 or 316 SS	B7M
500	3.4	750	5.1	B7 or 316 SS	B7M
1500	10	2250	15	B7 or 316 SS	B7M
3000	20	4500	31	B7 or 17-4 SS	718 Inconel
5300	36	5800	40	B7	718 Inconel

^a URL is "upper range limit," the highest pressure the transducer can measure.

^b SWP is the highest pressure that can be applied to the transducer without damage.

RTD Input with MVT

Quantity	1
Type	100Ω 4-wire lead compensation
Range	-200°C to +850°C (-325°F to +1560°F)
Accuracy	± 0.28°C (± 0.5°F) @ 25°C (77°F) ambient including RTD linearization
Temperature Effect	± 1.0°C over entire Scanner operating range

RTD Element

½" FNPT field-adjustable fitting adapts to thermowells with up to 5" (127 mm) U-dim (longer elements optionally available). The ¼" diameter element has 10 foot (3m) or 30 foot (9m) leads sheathed in stainless steel armor. RTD accuracy is +/- 0.1 ohm @ 0°C.

RTD (Analog) Inputs

Quantity	3 (up to 2 on the main board plus 1 with MVT/RTD) ^a
Type	100Ω 3-wire lead compensation
Range	(Default) -45°C to +120°C (-50°F to +250°F) (User-enterable) up to +210°C (410°F), if lead compensation is less than 1Ω
Accuracy	± 0.25°C (± 0.45°F) @ 25°C (77°F) ambient including RTD linearization
Temperature Effect	± 1.0°C over entire Scanner operating range

^a Each mainboard RTD input can be firmware-selected as two analog inputs, with the same specifications as the Analog Inputs.

Analog Inputs

Quantity	6 maximum (2 on the main board plus each RTD input can be configured as two analog inputs)
Type	1-5V or 4-20 mA with 250Ω load resistor
Accuracy	± 0.050% of span max. error @ 25°C (77°F)
Temperature Effect	± 0.3% over entire Scanner operating range
Impedance	>10 MΩ (1-5V input) approximately 250Ω (4-20 mA input)
Over Voltage Protection	± 30 VDC
A/D Resolution	16 Bit
Linearity Error	± 0.020% Max.; ± 0.010% typical

Pulse Inputs

Quantity	1 or 2 configured using DIP switch settings
Status Signal Types	3.7V threshold, or open collector, or contact closure.
Over Voltage Protection	± 30 VDC
Pulse Signal Types	Preamplified square wave (3.7V threshold) Open collector Contact closure Turbine magnetic pickup coil with auto-variable threshold noise filter

Pulse Type	Maximum Low Level Signal	Minimum High Level Signal	Frequency Range	Input Impedance
Square Wave	0.8V	2.2V	0-8 kHz	>100 kΩ
Open Collector	2 kΩ	200 kΩ	0-10 kHz	N.A.
Contact Closure	2 kΩ	200 kΩ	0-15 Hz	N.A.
	Minimum Signal Levels			Impedance
Magnetic Pick-up	20 mV p-p @ 20 Hz 20 mV p-p @ 100 Hz 200 mV p-p @ 1000 Hz 400 mV p-p @ 2000 Hz 1000 mV p-p @ 5000 Hz			10 KΩ at 1 kHz

Discrete Inputs/Outputs

Quantity	up to 4 assignable/selectable
Types	status in, status out, pulse out
Maximum Voltage	± 30 VDC
Status/Pulse Out	Max. on-state current 100 mA
Maximum Pulse Output Rates	64 counts/second @ 50% duty cycle

Status Input Threshold

The following values are the guaranteed limits that the input will be detected as having a changed state. For example, with a 2.0V selection, the input will be detected as false (off) when the input is less than 0.5V and on when it is more than 3.5V. In typical operation, the trip transition points are within 0.5 volts of the nominal threshold. Status input functions are user-assignable for signaling alarms, controlling valves, interface to counters, etc.

Nominal Threshold	Maximum Low Level Signal	Minimum High Level Signal
2.0V	0.5V	3.5V
7.0V	5.0V	9.0V
10.0V	8.0V	12.0V
Contact In	2 KΩ	200 KΩ

Analog Output

The analog output is user-assignable to any rate function (flow rate, temperature, control etc.).

Quantity	1
Types	4-20 mA, optically isolated, externally powered
Maximum Voltage	± 40 VDC
Status/Pulse Out	Max. on-state current 100 mA
Maximum Pulse Output Rates	5 counts/second @ 50% duty cycle
Accuracy	± 0.1% of span max. error @ 25°C (77°F) (after calibration)
Temperature Effect	± 1% of span max. error over temperature
Output Load	$R \text{ (ohms)} = \{\text{Supply (volts)} - 5.5\} / 0.02$
Maximum Voltage	± 30 VDC
D/A Resolution	12 Bits
Calibration	Zero and full-scale via software
Settling Time	<100 msec. to 0.1% of full-scale for a 10% step change
Supervisory circuit	On restoring analog loop power, output is 2 mA. On loss of RTU power, jumper select analog output to go to minimum level of 2 mA or retain last value.

Expansion Board Interface

The Scanner 1141 has a provision for an expansion board. The MIO2 expansion board standard configurations are with the following I/O or MVT/RTD only. The specifications for the expansion board are the same as the main board, unless otherwise noted.

Communications	1 MVT/RTD, serial TTL
Status Input/Status or Pulse Output	4 software selectable threshold in; MOSFET outputs
Analog Output	1 optically isolated output, 4-20 mA
Pulse Input	1 pulse input (for volume accumulation)

Transmitter and Auxiliary Power Supply

There are several options for powering transmitters and other external devices from the mainboard.

- Current Limited Transmitter Supply (CL): a resistively limited output that is “powered” from the higher of the battery and power input voltages. Limited to about 50 mA. “VTx1” on order code input options B1, M1 and FL.
- +12V, 30mA Voltage Limited Transmitter Supply (12VL): the supply is generated by a linear regulator that is powered from the higher of the power input or battery supplies, so that it remains valid anytime there is a power source for running the computer. The regulator has a low (250mV) dropout, so that the output will remain above 10.0V down to the typical cutoff voltage for a 12V SLA battery. This solution is not suited to 6V battery powered systems that require a transmitter supply. “VTx2” on order code input options B1 and M1.
- +12V, 30mA Stepup Transmitter Supply (12V): For +6V battery systems, the charge pump is required to provide an adequate transmitter supply down to the lowest (battery) voltage of operation. For 12V battery systems transmitters that have a maximum voltage less than the power input can be connected to this terminal. There is also a current limiter added to the charge pump output to prevent damage in the event that the transmitter supply is shorted in the field. “VTx2” on order code input option FL.

Two separate short circuit protected outputs are optionally available for the purpose of powering radios and other devices. All “Division 2 only” configurations have an 18-watt protected switch that is the higher of the power input or battery voltage. For example, with 18V power input, 1 Amp maximum would be available for powering a radio. The FL configuration also has a +5V @ 200mA output that can then be used to directly power +5V radios or to act as a logic level control signal for +12V radio systems. Both supplies can be turned on and off in firmware to conserve power in communication devices. These two outputs can be turned off by setting the low battery alarm, and turned on when the battery voltage exceeds the low battery alarm by the deadband.

Power Supply & Battery Charge Controller

For Class I, Division 2 applications, the Scanner 1141 is powered by a battery charger that is integrated into the main board with a step-down switching regulator power supply. The integral charge controller can be firmware-configured to work with either 6V or 12V sealed lead acid (SLA) batteries. Other battery chemistries (such as nickel cadmium) can be accommodated with a firmware modification.

The following high-temperature SLA batteries rated for +70°C (+158°F) or higher, enable a Scanner 1141 operating temperature of +60°C:

- Eagle Picher CF-6V58FR-S9; and CF-12V29FR
- C&D Technologies Inc. MPS12-33 and MPS12-50

With a standard temperature SLA battery, the 1141 operating temperature is -40°C to +40°C (-40°F to +104°F).

Class I, Division 2, Integral Battery Charge Controller, 6V or 12V



CAUTION

CAUTION

This caution is only applicable when a battery is connected to terminals 2 & 3 (BATT+ & BATT-)

The power supply must be current limited to 10 amps maximum and also be short circuit protected.

All solar panels are short circuit capable and can therefore be used with the 1141, provided they do not exceed 10 amps.

In normal operation the 1141's charging module will allow electrical current to flow to the battery unrestricted. The amount of current flow will vary depending on size of the battery and present charge level (voltage) of the battery and the voltage of the power supply.

The temperature-compensated battery charge controller on the main board has a two-step charge control algorithm in firmware. The circuit functions as a "pulse mode" charger (rather than a linear regulator) for bulk charging and relies on a current-limited power source for proper operation. The optional 3A constant current/constant voltage smart charger with current monitor is used to ensure the battery has reached full capacity.

- Bulk Charging

The Bulk Charging option is a protected 10A, high-side (mosfet) switch that is controlled by the Scanner 1141's microcontroller. The microcontroller uses a temperature-corrected, dual-level charging algorithm which will charge the battery at the maximum current that the solar panel can provide. Charging continues until the overcharge voltage is reached; at that point, the voltage

enters the overcharge (“VoverCharge”) state.

Once VoverCharge is reached, the bulk charger will be left on based on a set period of time at or above the overcharge voltage. To prevent battery damage, the overcharge state is terminated immediately if the battery voltage reaches more than 0.5V above the overcharge voltage.

The float state is always entered once the overcharge state is terminated.

The pulse-mode method of charging is done by monitoring the battery voltage and turning the switch on whenever charging is deemed necessary. A DC supply can be used, provided it is current-limited to 10A.

- **Smart Charger Constant Current / Constant Voltage**

When the smart charger is used with the bulk charger, the bulk charger will quickly recharge a depleted battery to approximately 80% capacity. The smart charger then brings the battery to a full charge and maintains the charge until bulk charging is once again required.

The smart charger provides up to 3 amps of charging current and delivers a constant current into the battery until it reaches the programmed overvoltage setpoint. At this point, the charger will transition to its constant voltage mode, while continuing to deliver charge into the battery until it is fully charged. The battery is considered to be fully charged when the charging current has fallen to a preset level (as programmed according to the size of the battery being charged). At this charge termination point, the charger is switched to float mode, and the programmed float voltage is maintained by delivering charge to the battery as necessary.

The "trickle state" exists when battery voltage is severely discharged to a point below a preset level called (“vTrickle”). When the battery voltage is below “vTrickle,” the smart charger will charge the battery voltage up to the “vTrickle” level at a lower trickle current.

The power supplies on the main board allow the user to input a single variable voltage. The power supply provides the various regulated voltages required by the RTU. In applications where a lead acid battery is integral, the power supply recharges that battery. This function can continue whether the RTU is switched on or not. As applicable, all power supplies report the input voltage and the battery voltage to the mainboard. This information is available for remote monitoring.

Sealed Lead Acid Battery

A sealed lead acid battery is paired with a temperature-compensated charge controller for charging the battery. A high-side bi-directional current monitor may be used to measure the current flowing into the battery (charging) or out of the battery (discharging). It is an optional item that provides a power system troubleshooting aid.

1. Input Current Limit: 10A maximum
2. Maximum Input Voltage 28 VDC
3. Input Voltage: Transient protection on input
Voltage drop of 3 VDC nominal

Sealed Lead Acid Battery	12 VDC System	6 VDC System
RTU shut down	10.5 VDC	5.6 VDC*
RTU restart	11.0 VDC	5.9 VDC*
Linear temperature coefficient	-23.6 mV/°C	-11.8 mV/°C
Float Charge Voltage		
At -20°C	15.4 VDC	7.68 VDC
At 25°C	14.1 VDC	7.05 VDC
At 50°C	13.4 VDC	6.7 VDC
Bulk Charge Voltage	Float voltage plus 0.9 VDC	Float voltage plus 0.45 VDC
Over Charge Voltage	15 VDC	7.5 VDC
Trickle Charge Voltage	10.2 VDC	5.1 VDC

* For order code input options B1 and M1, RTU shutdown is 6.1V and restart is 6.4V.

DC Input

A DC input accepts power from an external current-limited DC power source connected to the power terminals.

Input Voltage	6 to 28 VDC
Input Current Limit	10A maximum
Power Management	Shuts down at 5.3 VDC

Battery Charge Indicator

As a battery is charged, it progresses through up to four stages or “states.” The LED in the upper left corner of the circuit board indicates the state of the battery charge by the frequency of blinks it emits. The table below shows how the blink pattern of the LED corresponds to the state of the voltage charge. The faster the LED blinks, the lower the voltage that is retained by the battery. For example, when the LED blinks twice per second, the battery is severely discharged and is considered to be in the “trickle” state. When the LED blinks only once every 5 seconds, it is fully charged and the controller attempts to maintain that charge.

State	V _{BAT} (Temp. Compensated)	CC/CV Programmable Charger	Bulk Charger	LED Blink Pattern*
Trickle State (battery recovery)	< V _{Trickle}	ON if installed: V=V _{overCharge} I=i _{Trickle}	OFF	Twice per second
Bulk Charge State	>V _{Trickle} <V _{overCharge}	OFF if bulk charger installed, otherwise ON: V=V _{overCharge} I=i _{Max}	ON, if installed	Once every 2 seconds

State	V _{BAT} (Temp. Compensated)	CC/CV Programmable Charger	Bulk Charger	LED Blink Pattern*
Overcharge State	>VoverCharge <VoverCharge + 0.5	ON, if installed: V=VoverCharge I=iMax	OFF if smart charger installed, otherwise ON for overcharge Time (seconds)	Once every second
Float Charge State	>VstageReset	ON if installed: V=VFloatHigh I=iMax	OFF if smart charger installed, otherwise duty cycled ON when below VFloatLow	Once every 5 seconds

* LED blinks only if a charging source is present

Accessories

CSA Class I, Division 2 certified radios and modems can be included in the Scanner 1141 enclosure. Since these devices are rated up to +60°C (+140°F), the Scanner 1141 operating temperature must be reduced to +50°C (+122°F).

Lightning arrestors are also available for radio antenna connections. Since these devices are rated up to +50°C (+122°F), the Scanner 1141 operating temperature must be reduced to +40°C (+104°F).

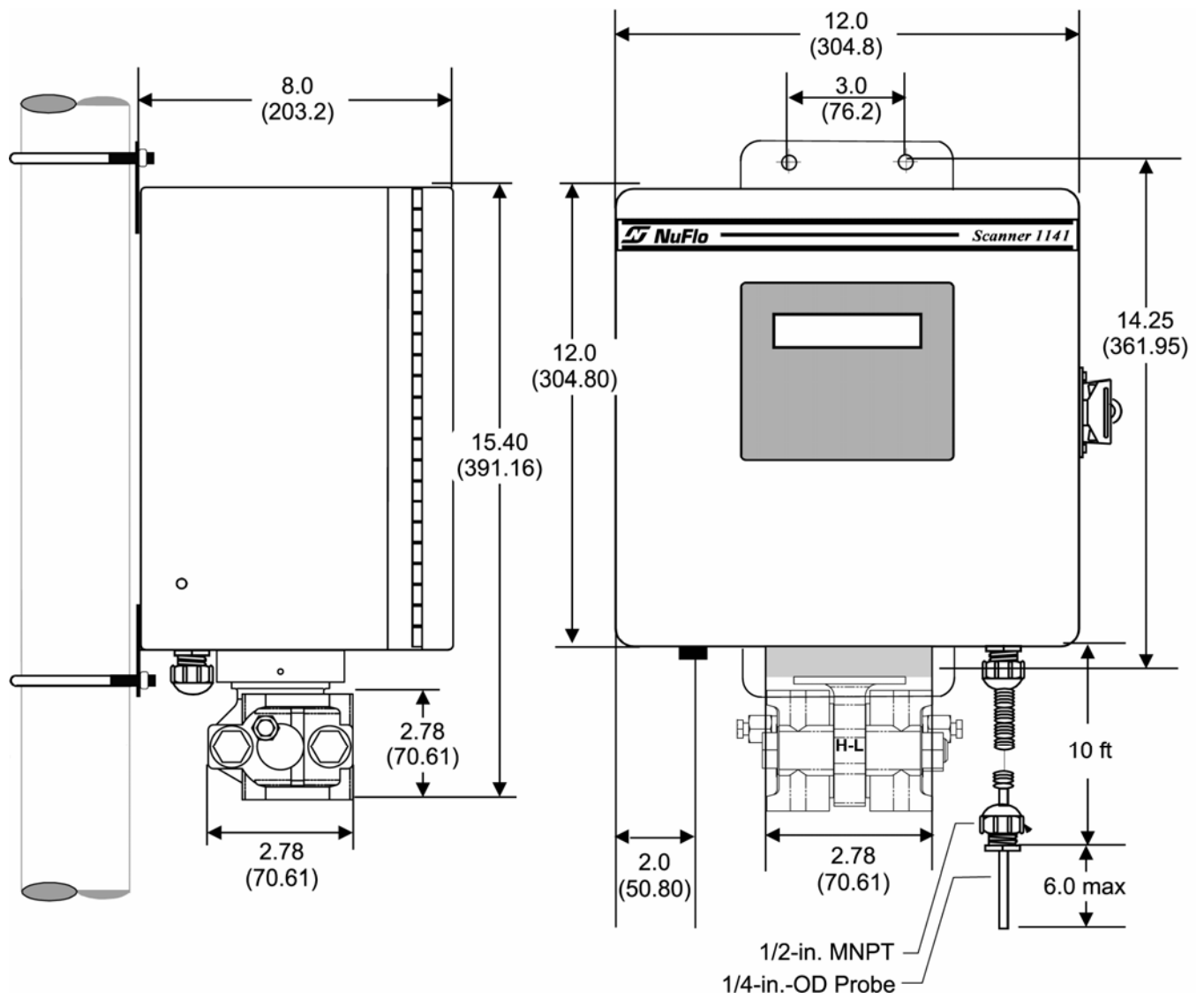
Currently, remote communication devices and lightning arrestors require CSA special acceptance.

Firmware

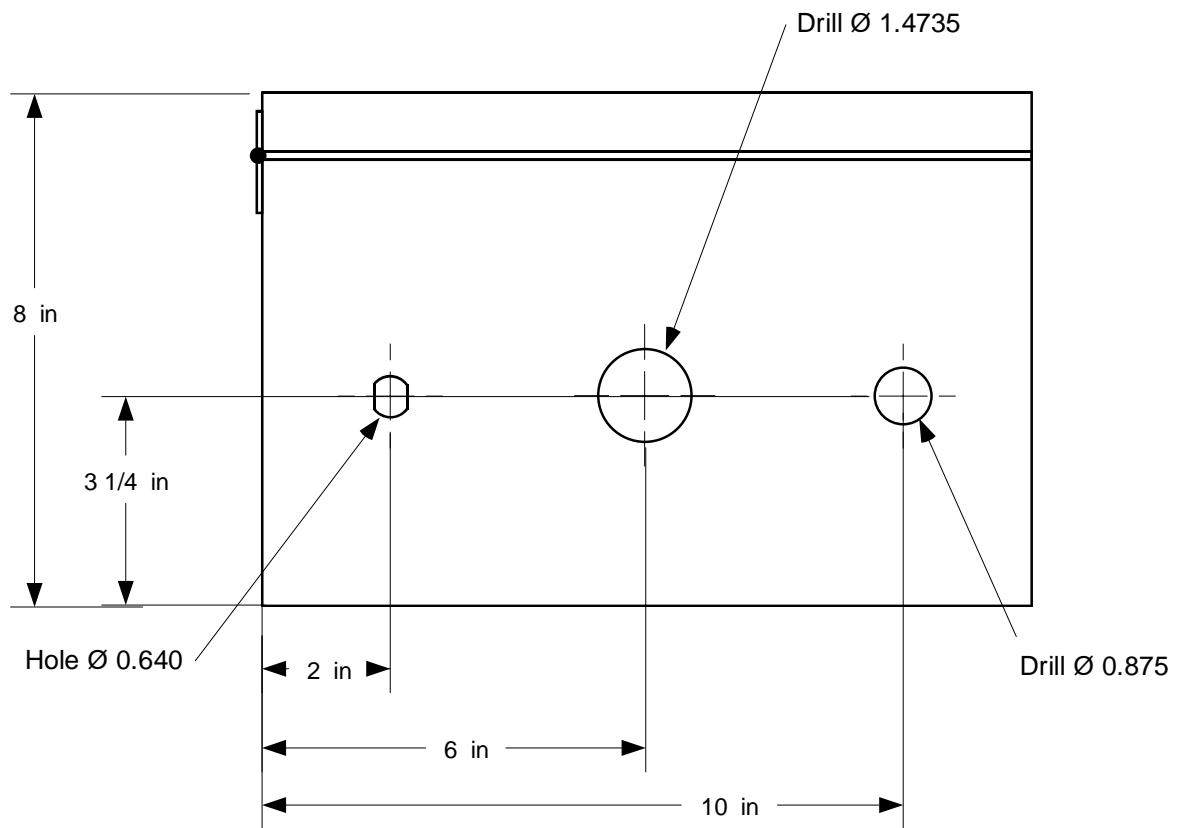
The Scanner 1141 supports version 4.3.5 and higher of the standard Scanner 1100 Series firmware for turbine and orifice measurements. Two or three flow runs can be configured in the Scanner 1141, within the limits of memory (256 Kbytes of RAM/NVRAM) to perform the following calculations:

- AGA-3 calculations for orifice metering using MVT, MVX-II, analog and RTD inputs
- AGA-7 calculations from a linear flow meter, such as a turbine meter
- flow through a liquid stream based on pulse or analog inputs
- monitor runs to measure pulse input totals or analog inputs

Scanner 1141L (Front and Side Views)

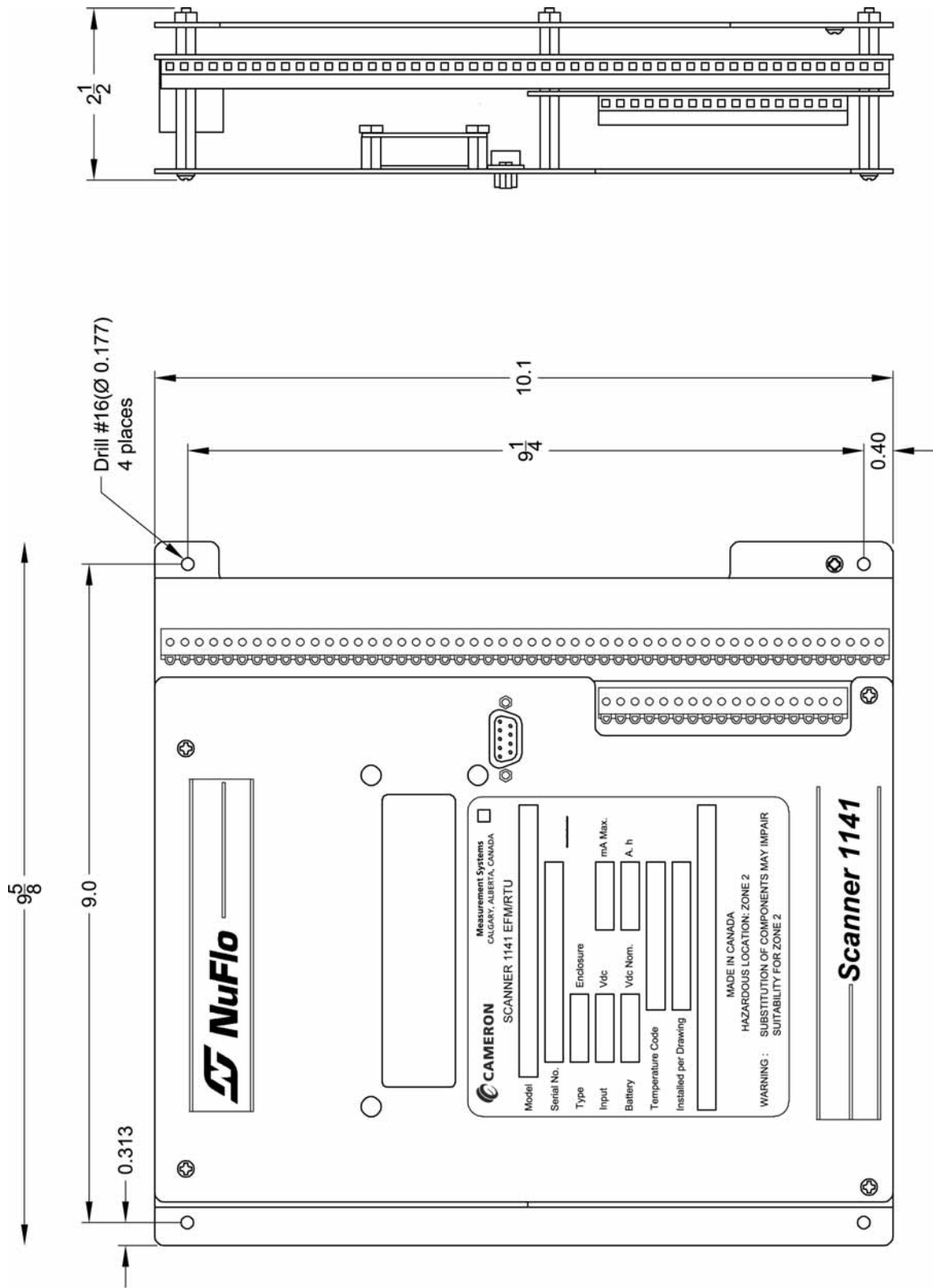


Scanner 1141L (Bottom View of Enclosure)



Notes: 1. All dimensions in inches. Tolerances: Fraction $\pm 1/32$ ", Decimals $0.XX \pm 0.01$ ", $0.XXX \pm 0.005$ "

Scanner 1141G

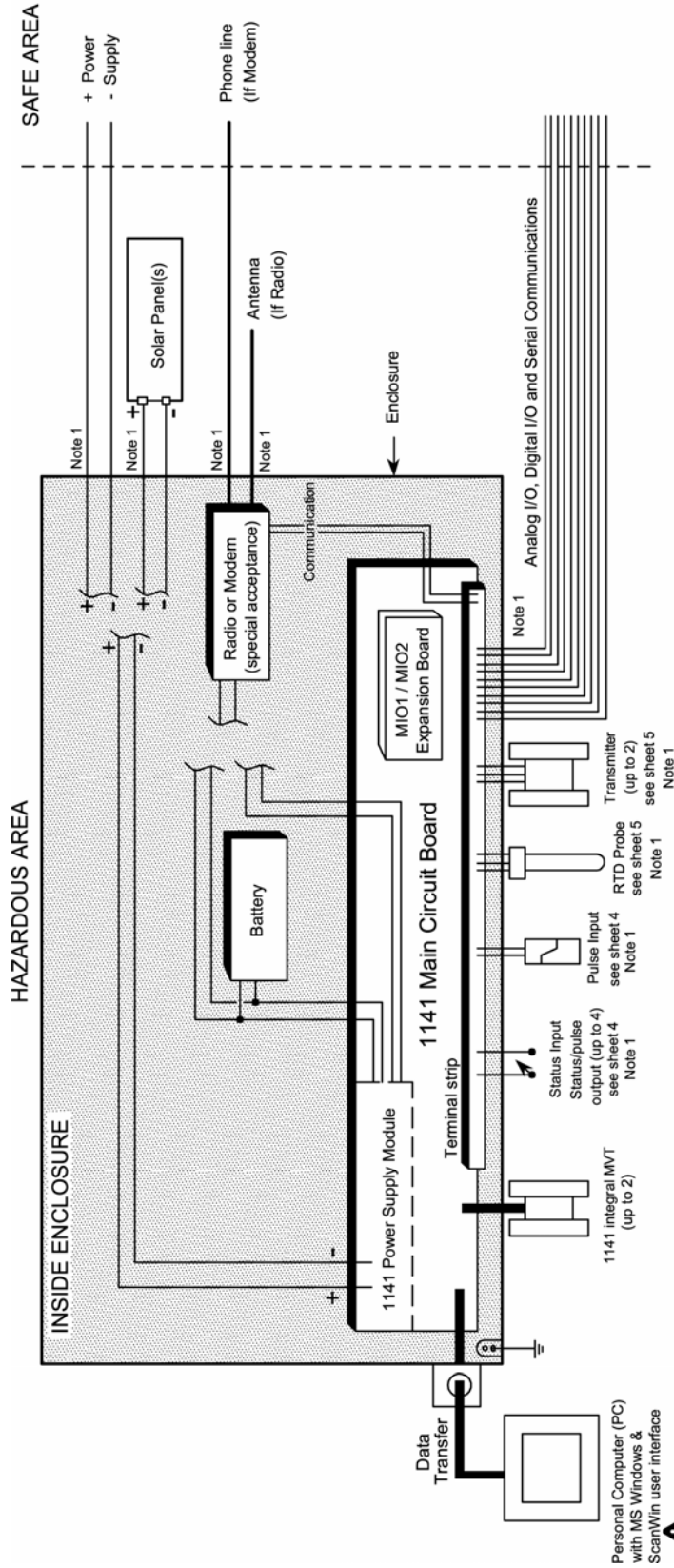


Appendix **B**: Control Drawings

Drawing 1141-11012: Installation, Class I, Division 2

Class I, Div. 2 Control Drawings

1: Installation	96
2: Power Supply	97
3: Communications (Serial Ports)	98
4: Status & Pulse Inputs/Outputs	99
5: RTD Inputs & Analog Inputs/Outputs	100
6: Analog Outputs	101

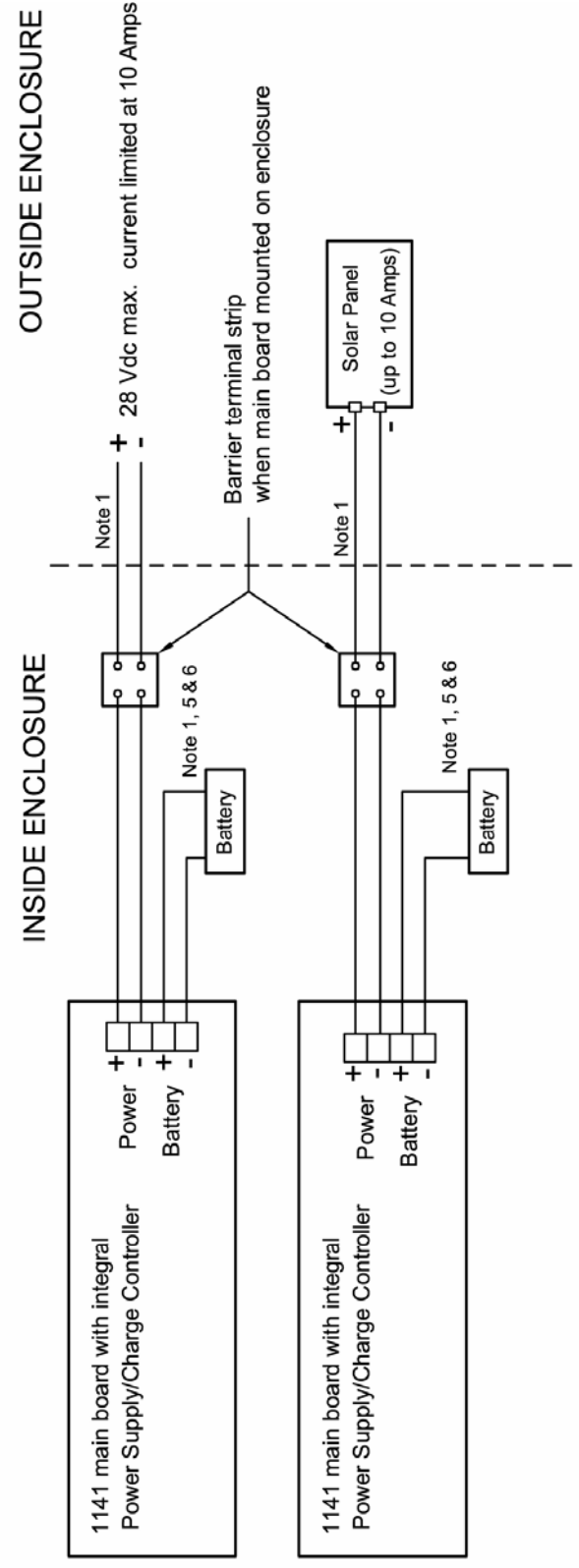


Notes: Suitable for use in Class I, Division 2, Groups A, B, C and D hazardous locations and nonhazardous locations only.
WARNING - EXPLOSION HAZARD. Do not connect or disconnect connectors within the 1141 while circuit is live unless area is known to be nonhazardous.
WARNING - EXPLOSION HAZARD. Substitution of components may impair suitability for Class I, Division 2.
WARNING - EXPLOSION HAZARD. Batteries must only be changed in an area known to be nonhazardous.

1. Observe CEC/NEC Class I, Division 2 wiring practices where conductors enter or leave the enclosure unless otherwise noted herein.
2. **WARNING - EXPLOSION HAZARD.** When using a personal computer (PC) to access the ScanWin user interface, do not connect or disconnect this interface unless the area is known to be nonhazardous. Secure the cover on access port using the cover and screws provided when not in use.

Drawing 1: Installation

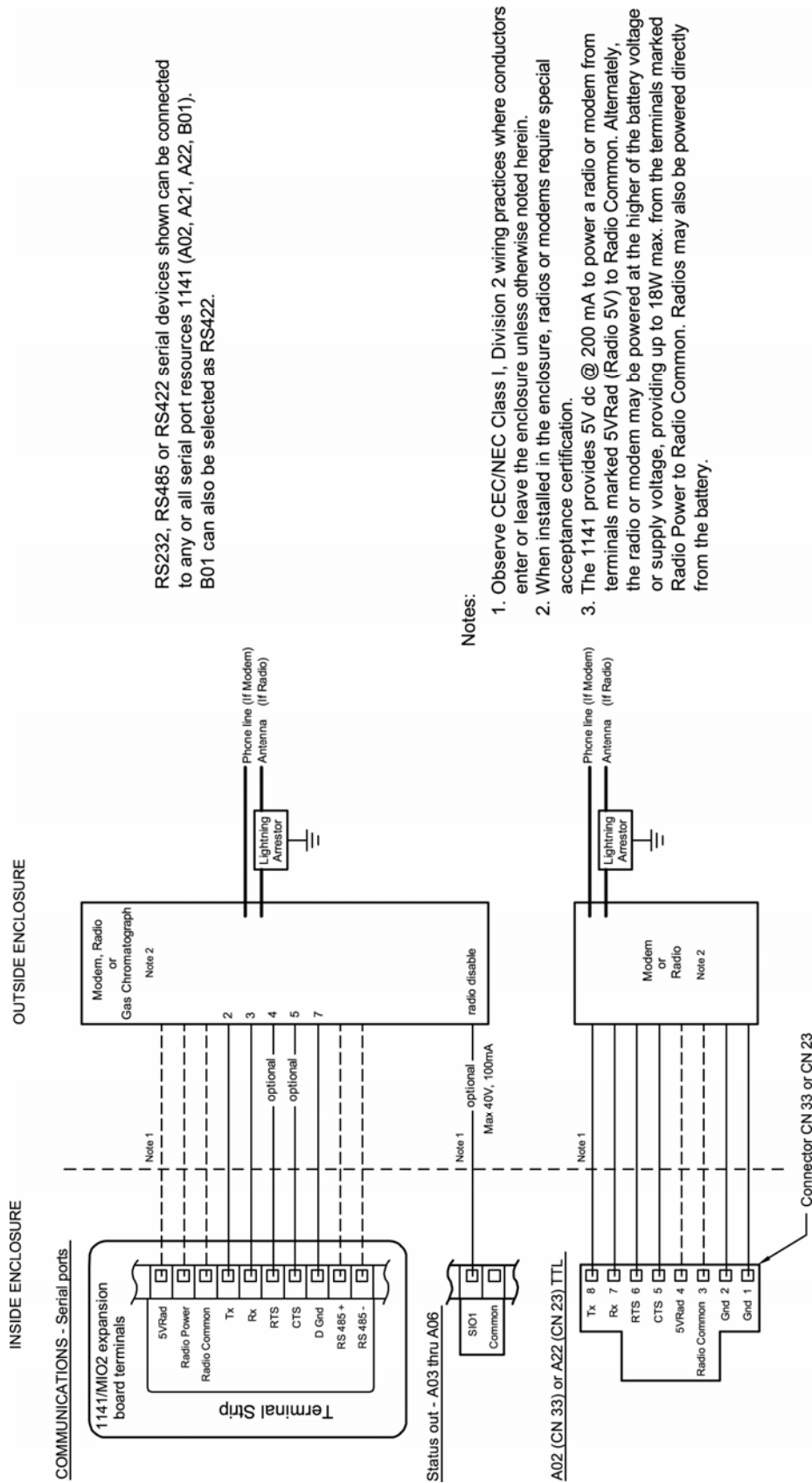
POWER SUPPLY



Notes:

1. Observe CEC/NEC Class I, Division 2 wiring practices where conductors enter or leave the enclosure.
2. External power supply must be limited to 10 A maximum, 27.5V dc maximum.
3. Solar panels: Any manufacturer and model may be used, with maximum ratings that do not exceed 27.5V open circuit, 10A short circuit. (Approximately 275W) when wiring per note 1.
4. Rechargeable batteries may be Sealed Lead Acid, Sealed Absorbed Technology, or Valve Regulated Lead Acid with a maximum rating of 12V dc and 300Ah.
5. Battery may be mounted in a separate enclosure.

Drawing 2: Power Supply

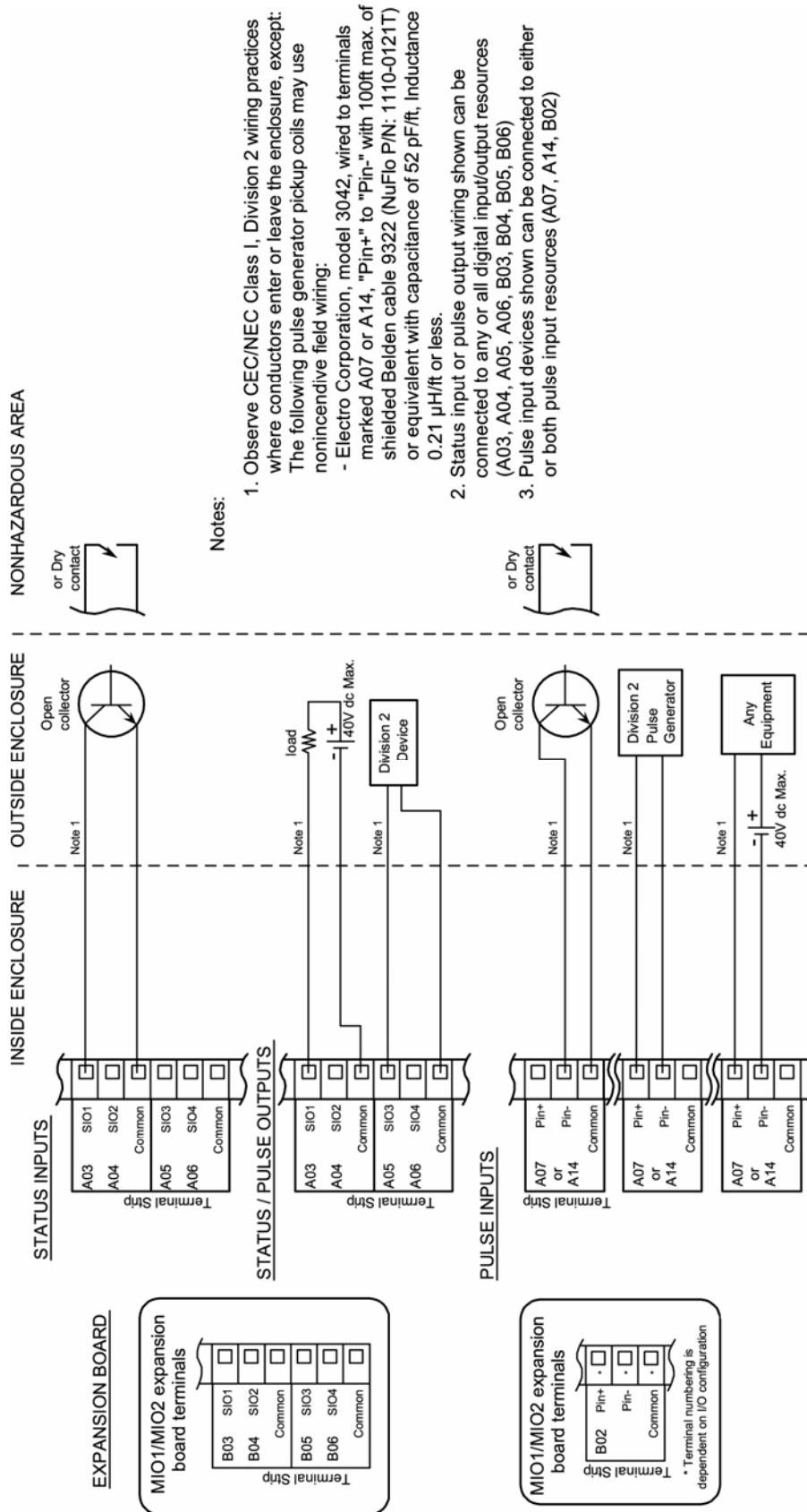


RS232, RS485 or RS422 serial devices shown can be connected to any or all serial port resources 1141 (A02, A21, A22, B01). B01 can also be selected as RS422.

Notes:

1. Observe CEC/NEC Class 1, Division 2 wiring practices where conductors enter or leave the enclosure unless otherwise noted herein.
2. When installed in the enclosure, radios or modems require special acceptance certification.
3. The 1141 provides 5V dc @ 200 mA to power a radio or modem from terminals marked 5VRad (Radio 5V) to Radio Common. Alternately, the radio or modem may be powered at the higher of the battery voltage or supply voltage, providing up to 18W max. from the terminals marked Radio Power to Radio Common. Radios may also be powered directly from the battery.

Drawing 3: Communications - Serial Ports



Notes:

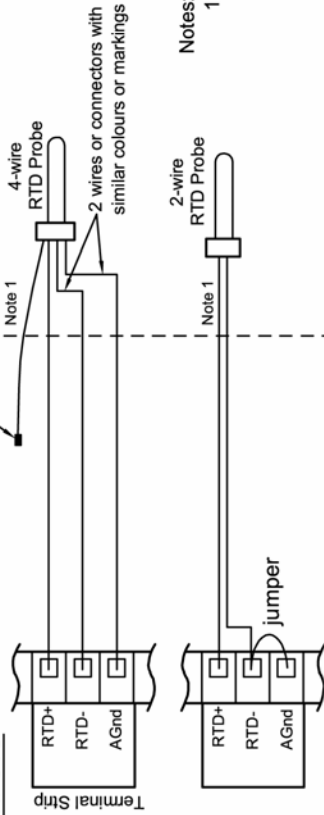
1. Observe CEC/NEC Class I, Division 2 wiring practices where conductors enter or leave the enclosure, except: The following pulse generator pickup coils may use nonincendive field wiring:
 - Electro Corporation, model 3042, wired to terminals marked A07 or A14, "Pin+" to "Pin-" with 100ft max. of shielded Belden cable 9322 (NuFlo P/N: 1110-0121T) or equivalent with capacitance of 52 pF/ft, Inductance 0.21 μH/ft or less.
2. Status input or pulse output wiring shown can be connected to any or all digital input/output resources (A03, A04, A05, A06, B03, B04, B05, B06)
3. Pulse input devices shown can be connected to either or both pulse input resources (A07, A14, B02)

Drawing 4: Status & Pulse Inputs/Outputs

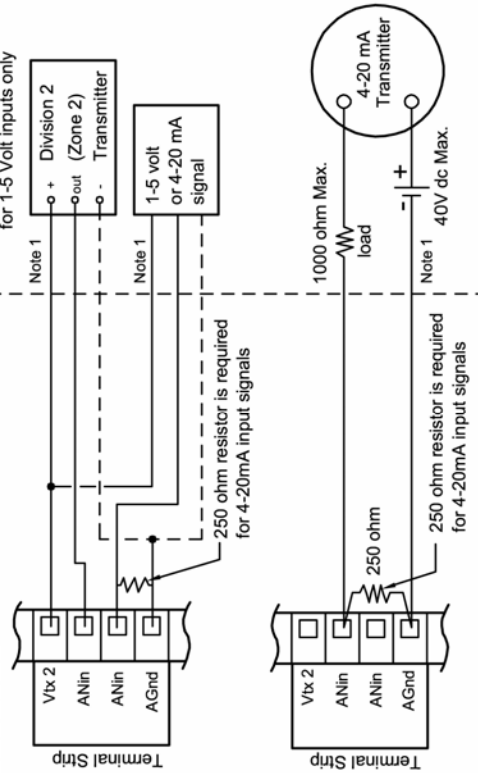
OUTSIDE ENCLOSURE

INSIDE ENCLOSURE

RTD INPUTS



ANALOG INPUTS



Notes:

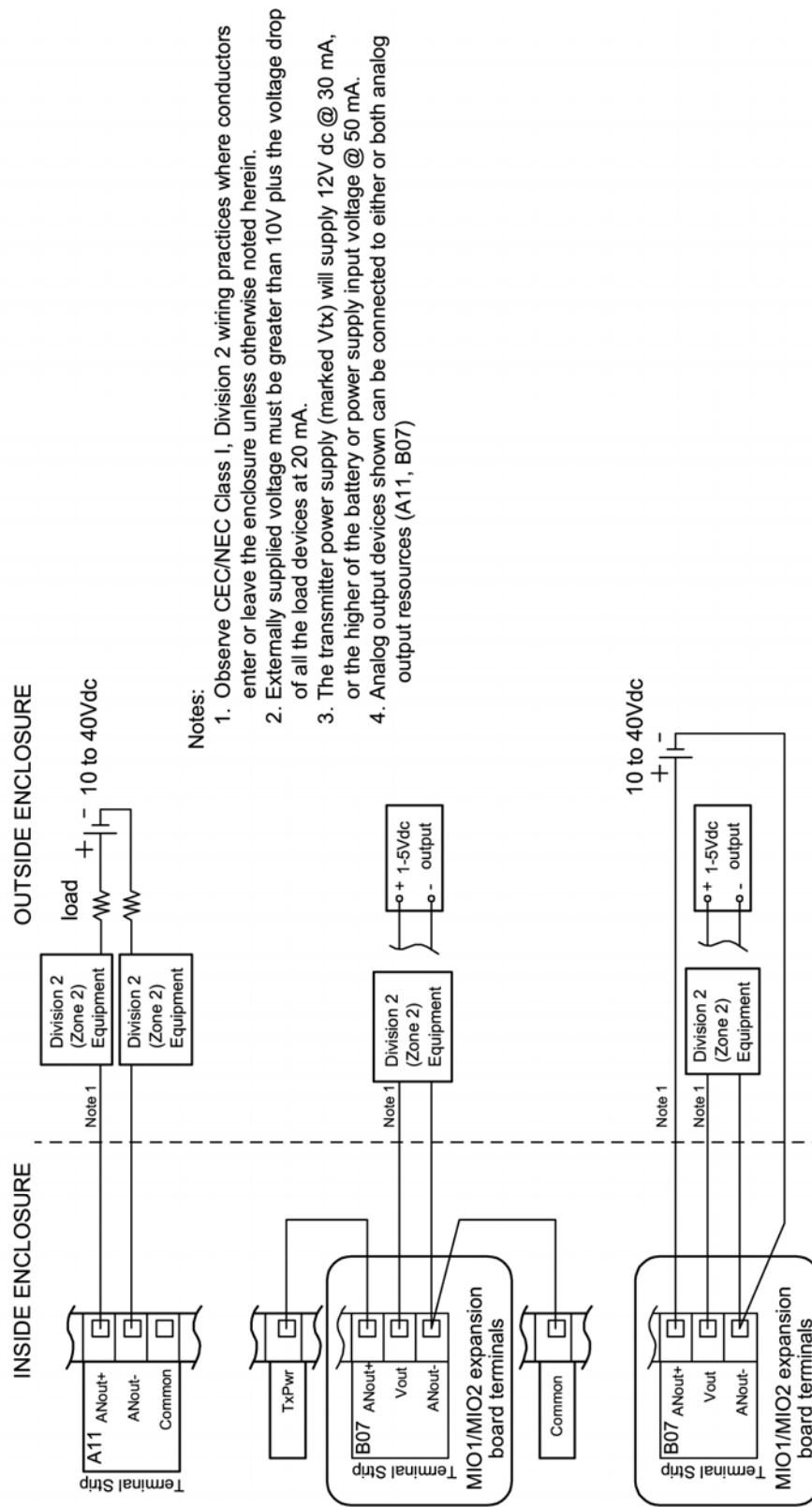
1. Observe CEC/NEC Class I, Division 2 wiring practices where conductors enter or leave the enclosure, except:
 - a. The following 3 wire or 4 wire RTD probes may use nonincendive wiring when wired to terminals labeled "RTD+", "RTD-", and "AGnd":

Manufacturer	Model	Reference Drawing	Notes
Barton		1130-11818	
Barton		1100-1002C	
Barton		1100-1010C	
Barton	20	3920-0020A	RTD Terminal Block housing

- If a 4 wire RTD is used, terminate and insulate the unused lead using heat shrink sleeving, or the equivalent.
- a. Any CEC/NEC Class I, Div. 2 transmitter with 1/2" MNPT electrical connector can be mounted directly to the 1141 enclosure, when installed per 1141-11022.
 2. The transmitter power supply (marked Vix) will supply 12V dc @ 30 mA, or the higher of the battery or power supply input voltage @ 50 mA.
 3. Analog input devices shown can be connected to either or both analog input resources (A09, A10, A16, A17, A19, A20).

Drawing 5: RTD Inputs & Analog Inputs/Outputs

ANALOG OUTPUTS



Drawing 6: Analog Outputs

Appendix C: Principles of Operation:

The Scanner 1141 was based on the following principles of operation.

Central Processing Unit (CPU)

The system board utilizes a microcomputer, which provides an interrupt controller, a clock generator, and a demultiplexed data and address bus. In addition, it contains two serial ports, an 8-bit comparator port, and digital control lines that can be used for interfacing with various types of digital I/O. Clock control, as well as halt and stop methods, allow the CPU to minimize system power.

Memory

There are three types of memory in the Scanner 1141: program FLASH memory, random access memory (RAM), and non-volatile random access memory (NVRAM).

Programs are stored in FLASH memory. FLASH memory enables the user to load new firmware from an IBM-compatible PC into the Scanner 1141 using WinsLoad or ScanFLASH.

RAM is used as a temporary storage during normal program execution. RAM is volatile; any data held in RAM is lost if a power failure occurs.

NVRAM is the system's long-term storage memory for large blocks of vital data (e.g. configuration data, logs, etc.) that must be protected if there is a power failure. NVRAM power is backed by a small replaceable on-board lithium battery. If a loss of voltage is detected, the system immediately saves all necessary data in the NVRAM. When power is restored, the computer resumes exactly where it stopped when the power failed. The NVRAM is guarded against changes. NVRAM is only written when there is a configuration change, a power failure, or if a system restart is performed. This restriction protects vital configuration and measurement data from being lost if there is an electrical transient or an uncontrolled program.

FPGA

A Field Programmable Gate Array (FPGA) is used to provide support logic for the CPU as well as provide a number of additional I/O ports. This RAM-based program is loaded from FLASH memory at system startup, allowing the logic to be modified and updated along with the application code, adding flexibility to the system.

The FPGA generates the entire read and write information for the memory, I/O spaces, as well as chip select outputs for all the memory devices.

In addition, the FPGA contains logic for:

- controlling interrupts
- a programmable counter for generating the system "heartbeat interrupt"

- a debounce circuit
- a counter for the pulse input
- automatic dispensing of pulses to the pulse output ports
- interfacing to the serial ports
- simple output for controlling the A/D system
- analog outputs
- transmitter supplies
- the “watchdog” timer

Clocks and Timers

The CPU clock provides 7 MHz to run the microprocessor. In power-save mode, the CPU clock automatically shuts down when the processor is inactive.

The real-time clock is a combined clock and calendar with leap years. It provides all timing functions to the flow computer including the generation of the “heartbeat interrupt” (see **Power Management** below) which runs the real-time kernel. The real-time clock provides the accurate time base for volume integration, estimation, history and data logging, and all other timing functions. The real-time clock runs continuously; during power outages, it draws power from the memory backup battery.

The “watchdog” timer prevents the microprocessor from stalling in a loop (e.g., the processor waits for an input signal that never arrives). If a loop occurs, the Watchdog Timer resets the program to the initial start point and normal operation continues. Watchdog Timer resets are logged in the Event log.

Power Management

The Scanner 1141 uses a sophisticated power management system to optimize measurement and control operations while minimizing power use. A single power input is required; all other supplies are generated from the mainboard.

To conserve energy, the display automatically shuts down when it is not in use. A push-button switch on the circuit board is pushed to “wake-up” the display. Any display item can be paused for viewing by pressing the wakeup button.

A “heartbeat interrupt” pulse triggers the processor periodically for internal process operations. When the power-saver mode is ON, the real-time clock provides a “heartbeat interrupt” signal that turns the CPU ON every 1/32 of a second. During this momentary ON period, the CPU performs any pending tasks. If no tasks are pending, the CPU shuts itself off.

Power is further conserved through cycling and duty-cycling the end device’s sampling and calculation frequencies. The RS-232C interface is software-controlled and manages power supplied to a radio or modem for minimum power consumption.

Analog Inputs

The analog input circuits read voltages from 0 to 5 VDC. Input devices with 1-5V outputs are connected to analog inputs and scaled from 0 to 100% by software. If 4-20 mA devices are used, optional precision load resistors can be installed.

Each input signal is connected to an input port on the analog multiplexer (MUX), which routes each signal sequentially to the input port of the A/D converter (see Figure C.1). The sampling interval is software-controlled (see Chapter 4 of the ScanWin Lite manual or Chapter 11 of the ScanWin Pro manual for information on Averaging Delay).

One of the MUX input ports is connected to a precision voltage reference and another port is connected to ground. This forms the basis for autocalibration. The CPU uses the readings from these ports to establish internal correction factors for the transmitter signals. Autocalibration corrects drift in the analog circuitry due to component age, temperature-induced gain variations, cross-channel leakage in the MUX, assorted component leakage, and other errors. Further corrections determined from the loop calibration data are applied to account for the end-device characteristics including static offset, linearity and hysteresis. Various checks ensure that the corrections are “reasonable.”

All analog inputs are single-ended (common ground). Therefore, some method of isolation may be required to share an analog signal with another device.

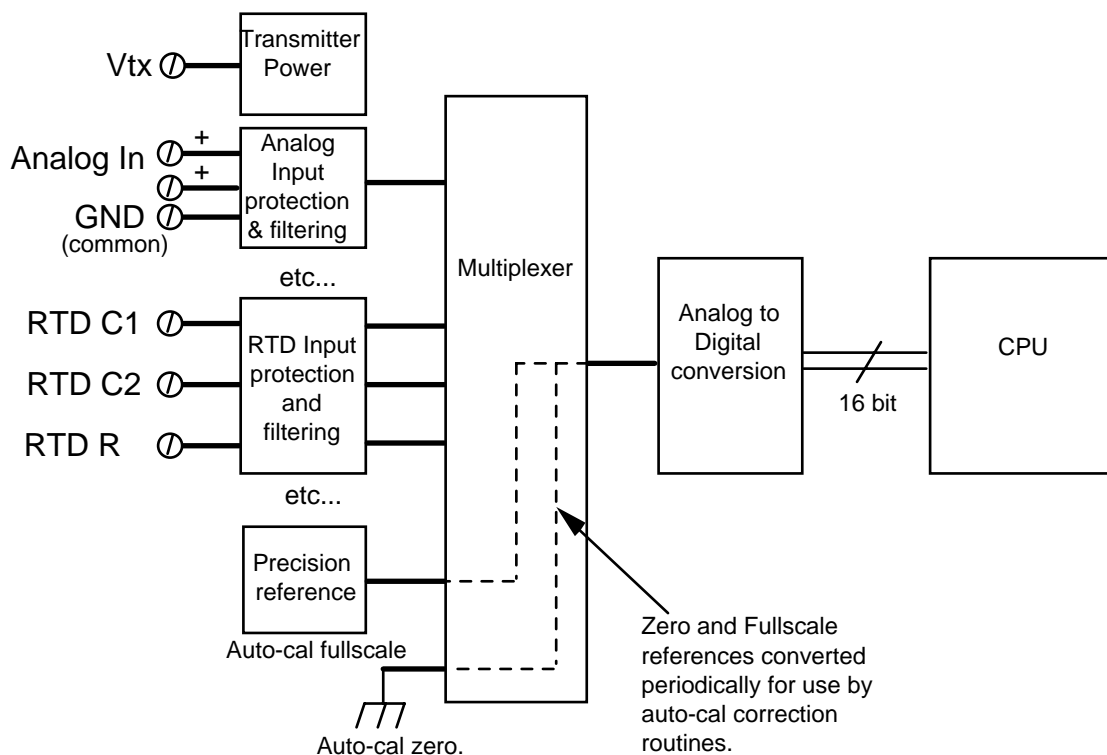


Figure C.1—Routing of analog input signals for conversion to digital readout

RTD Inputs

RTD inputs use a precision current source to measure the resistance of the RTD. Lead length compensation of the 3-wire RTD is accomplished by measuring the line resistance between terminals C1 and C2. The multiplexer, A/D converter and autocal are the same as the analog inputs. Each RTD input can be firmware-configured as two analog inputs.

Pulse Inputs

The Scanner 1141 optional pulse inputs are designed to interface with a wide variety of devices including variable-reluctance magnetic pick-up coils, and signals from turbine preamplifiers and simple contact closures. DIP switches select the type of signal to be used for each pulse input.

In all modes, the pulses are accumulated in a hardware register that is periodically read by the microprocessor in the CPU. The pulse count is used directly in volume calculations. The frequency (used to determine flow rate) is calculated using the time interval between successive pulses.

Appendix D: Input/Output Expansion Board

MIO2 Expansion Board

The Scanner 1141 MIO2 expansion board is a multipurpose I/O expansion card that provides an MVT/RTD TTL serial port on a 20 pin connector, a 1-5V/4-20 mA analog output and a multi-interface pulse input. Each of the interface types for the pulse input is switch-selectable. In addition, the board provides four ports that can be individually configured via software for operation as a status input, status output, or pulse output. The MIO2 installs in the Scanner 1141's expansion slot, and terminal blocks for field-wiring termination are soldered onto the expansion board. The configuration switches for the analog output and pulse input are located at the opposite end of the card from the terminals.

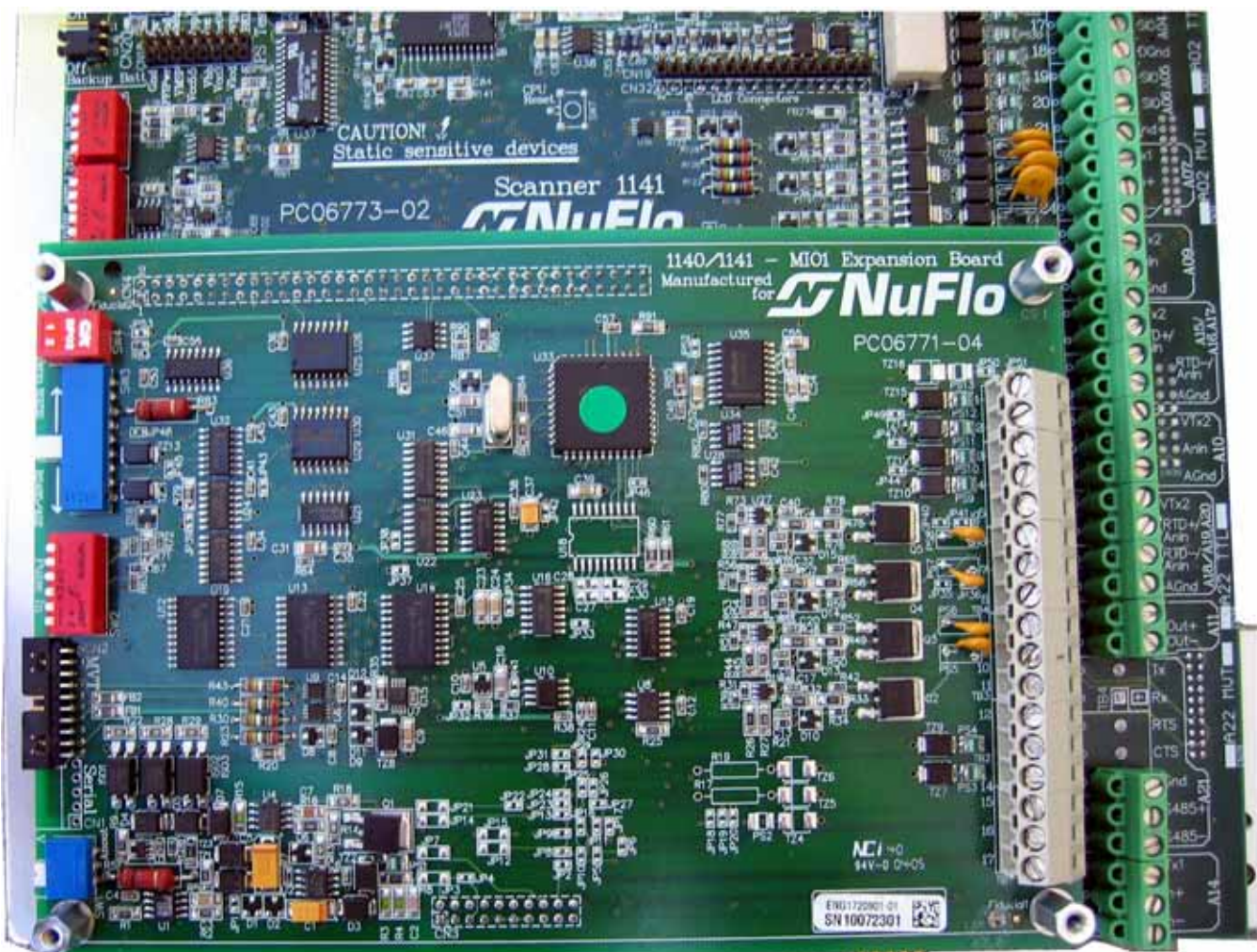


Figure D.1—The MIO2 expansion board mounts on standoffs directly above the bottom portion of the main circuit board.

Specifications

General

Operating Temperature	40°C to +60°C
Classification	CSA certified for Class I, Div. 2, Groups A, B, C & D
Relative Humidity	10% to 95% non-condensing

Serial Port

Quantity	1 (optional)
Port 1 Electrical Interface	MVT/RTD serial TTL

Analog Output

Quantity	1 (optional)
Isolation	Optically isolated to 500 VAC, externally powered
Type	Switch selectable as either 1-5V or 4-20 mA
Accuracy	±0.1% of full scale max. error @ 25°C (after software calibration)
Temperature Effect	±1% of full scale max. error over temperature
Minimum Operating Voltage	6.5 VDC (4-20 mA), 9.5 VDC (1-5V)
Maximum Voltage	±40 VDC
Minimum load (1-5V mode)	10KΩ
D/A Resolution	12 bits
Calibration	Zero and full-scale software calibration
Settling Time	<100 msec. to ±0.1% of span for a full-scale step change

Status In/Status Out/Pulse Outputs

The MIO2 board provides four (maximum) digital I/O channels that can be individually software-configured as status inputs, status outputs or pulse outputs. Each of the four channels is identical, and is implemented using a comparator for detecting the state of an (status) input, and an n-channel MOSFET to provide an open drain status output driver. Pulse outputs are provided by simply driving the status output on and off at the required pulse output rate in an interrupt driven software routine. The channels on the MIO2 board are identical to those on the mainboard.

Pulse Inputs

Quantity	1 (optional)
Pulse Signal Types	Pre-amplified square wave, open collector, contact closures, Pepperl & Fuchs inductive proximity sensor or turbine magnetic pickup coil configured via on board DIP switch.
Over-Voltage Protection	±40 VDC

Pulse Type	Maximum Low Level Signal	Minimum High Level Signal	Frequency Range	Input Impedance
Square Wave	3 V	3.7 V	0 - 8 kHz	> 10 KΩ
Open Collector	2 KΩ	200 KΩ	0 - 10 kHz	N.A.
Contact Closure	2 KΩ	200 KΩ	0 - 10 Hz	N.A.
	Minimum Signal Levels			Impedance
Magnetic Pickup Coil	20 mV p-p @ 20 Hz 20 mV p-p @ 100 Hz 20 mV p-p @ 1000 Hz 400 mV p-p @ 2000 Hz 1000 mV p-p @ 5000 Hz			10 KΩ @ 1 kHz

I/O Termination

Source	Terminal #	Description
B01 Serial Port	1	Tx – RS-232C transmit output RS485+ or RS422 Rx+
	2	Rx – RS-232C receive input RS485- or RS422 Rx-
	3	RTS – RS-232C request to send (RTS) output or RS422 Tx+
	4	CTS - Auxiliary serial port clear to send (CTS) input or RS422 Tx-
	5	DGnd – Digital ground
B03 Status I/O B04 Status I/O	6	SIO - Status input/output
	7	SIO - Status input/output
B05 Status I/O B06 Status I/O	8	DGnd - Signal common
	9	SIO - Status input/output
	10	SIO - Status input/output
	11	DGnd - Signal common
B02 Pulse Input	12	VTx1 - Power for transmitters
	13	Pin +, Pulse input positive
	14	Pin-, Pulse input negative
B07 Analog Output	15	AnOut+, Analog output
	16	Vout
	17	AnOut-, Analog output -
B08 MVT	CN12	Serial MVT port

Figure D.2 illustrates the position and orientation of this I/O termination connector as well as the serial port, pulse input, and analog output configuration switches.

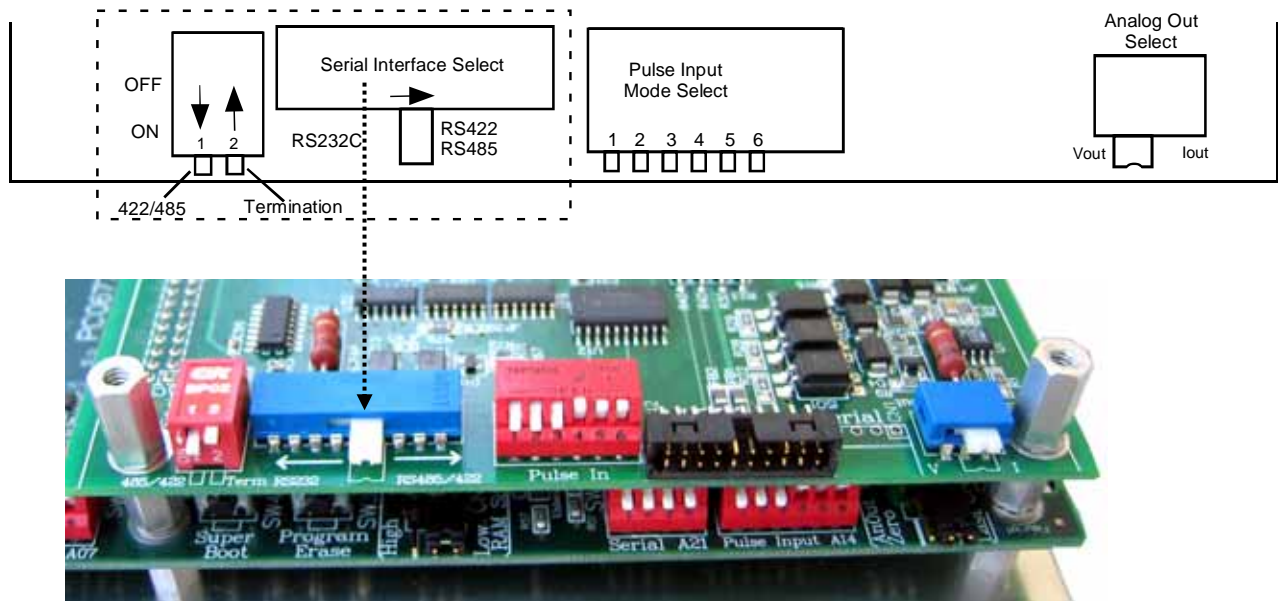


Figure D.2—I/O termination connector

Configuration Switches

As illustrated above, the board provides configuration switches for serial port, the pulse input and the analog output. A brief description of each of the switches is given below:

Status Input/Output and Pulse Output Circuits

All settings are software-selected. Hence, there are no switches to set.

Serial Port Switches

The serial port's configuration is controlled by both a 2-bit DIP switch and a multi-pole slide switch (see dotted area of Figure D.2). The slide switch selects between an RS-232C interface (left-hand position) and an RS-422/RS-485 interface (right-hand position).

DIP switch #1 selects between RS-422 (**open - OFF**) and RS-485 (**closed - ON**) interfaces when the slide switch is in the RS-422/RS-485 position). DIP switch #2 connects a 100Ω termination and should be closed (**ON**) for an RS-422 interface or if the MIO2 board is the last device on a multi-drop RS-485 network.

Pulse Input Switches

The six-position DIP switch is used to configure the pulse input circuitry to interface with a variety of pulse-producing devices. The function of the switches is the same as that of the switches on the

mainboard. A detailed description of the switch settings for each interface is given in the mainboard Pulse Input section.

Analog Output Switch

The analog output slide switch selects between 1-5V mode (left-hand position) and 4-20 mA mode (right-hand position). In voltage mode, power is applied between the Ano+ and Ano- terminals with the 1-5V output signal on terminal Vout (relative to Ano-). In current mode, the circuit operates as a two-wire device that controls the current flowing from Ano+ to Ano-. In this case, Vout is not used.

MIO2 Expansion Board Installation

The following procedure should only be performed by a trained technician in a **NON-HAZARDOUS** area.

1. Use ScanWin to download all configuration, calibration and historical data from the Scanner RTU.
2. Turn off the Scanner 1141 RTU by moving switch SW11 to the “down” position.
3. Disconnect the power supply to the Scanner 1141.
4. Remove screws or standoffs as follows:
 - For the 1141G, remove the cover plate and four lower standoffs.
 - For the 1141C and 1141L enclosures, remove the four lower screws that hold the mainboard.
5. Install 6-32 x 7/16-in. standoffs on the four lower mounting holes of the mainboard.
6. Remove the MIO2 board from the anti-static bag and install it on the expansion connectors on the mainboard (CN2 and CN16).
7. Reinstall screws or standoffs as follows:
 - For the 1141G, install four shorter standoffs and the cover plate.
 - For the 1141C and 1141L enclosures, reinstall the four screws.
8. Reconnect the power to the Scanner 1141.
9. Turn ON the Scanner 1141 RTU by moving switch SW11 to the “up” position.
10. Go to the Scanner Hardware page and verify that the resources are all recognized.
11. Configure any new features and test.

Appendix E: Flashing the Scanner

“**Flashing**” is the term used to describe the procedure that installs a different version of firmware other than the one with which the Scanner was shipped. **If changing the firmware is NOT necessary**, the startup procedure may be initiated. See [Startup Procedure](#), page 55, for details.

Reprogramming the flash memory of the Scanner 1141 with a new version of firmware requires the use of a loading program. The **WinsLoad** or **ScanFLASH** program is utilized in a Windows 3.1, 95, 98, NT, 2000 or XP environment.

Preparing to Flash

To change the firmware installed in the Scanner’s Flash memory, a PC with the WinsLoad or ScanFLASH program is required.

1. Connect the PC to the Scanner 1141’s console port (Figure E.1).

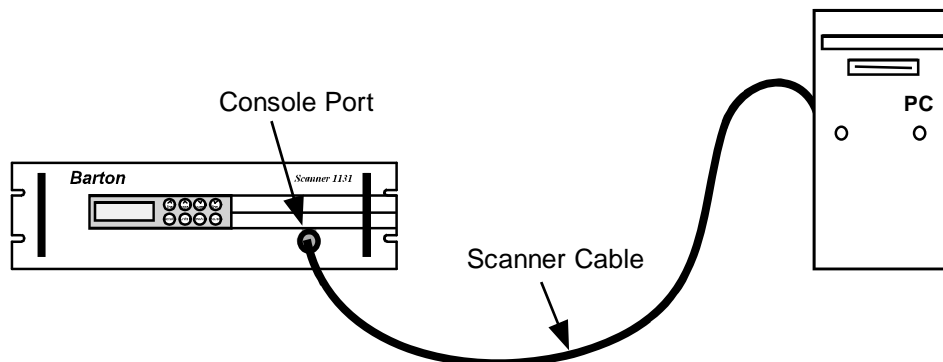


Figure E.1—PC to console connection for flashing firmware

2. Start ScanWin.
3. Download all history, configuration and calibration data. (**HIGHLY RECOMMENDED**)
4. Exit ScanWin.
5. With the *Power* switch (SW9) in the “ON” position, press and hold the Program Erase button (as show in Figure E.2) on the main circuit board to erase the existing Scanner firmware.
6. Move the *Power* switch (SW9) to the “OFF” position to “power down” the Scanner 1141.
7. If the *Configuration Locking* switch (SW11) is installed, verify that it is UNLOCKED.
8. Proceed to flash a new firmware version with WinsLoad or ScanFLASH.

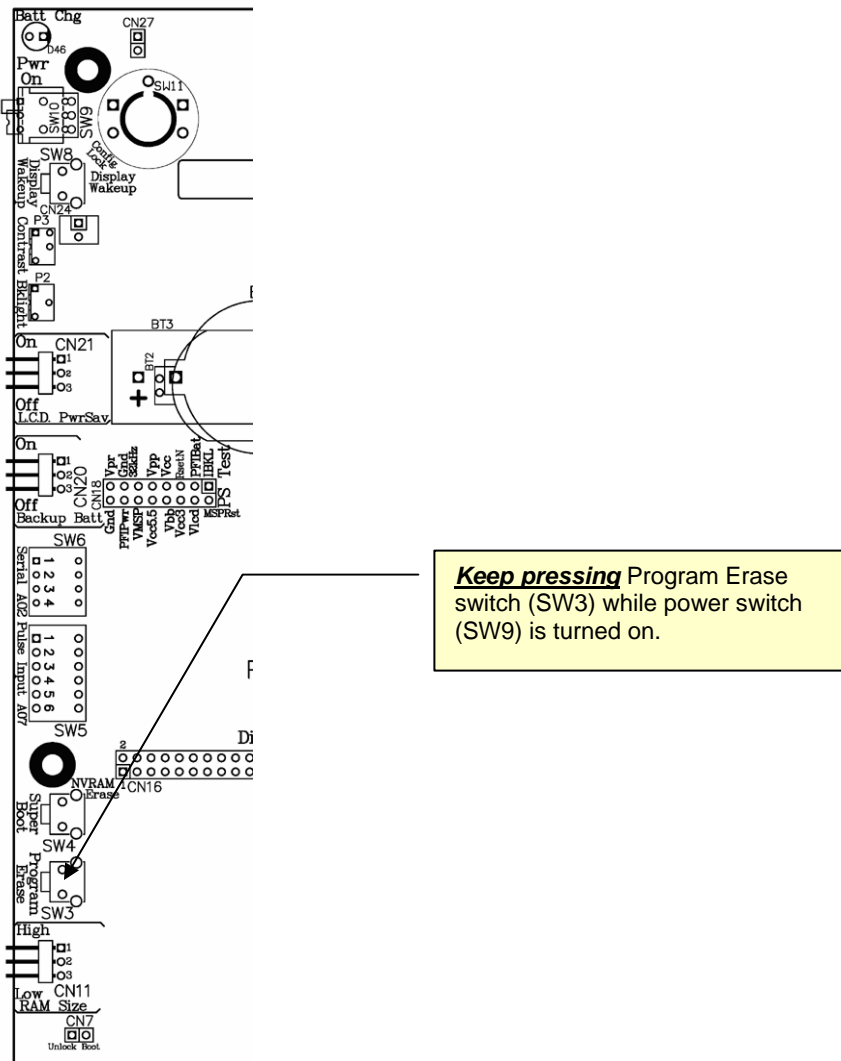


Figure E.2—Location of *Program Erase* switch

Before Flashing

If the Scanner EFM/RTU has been in service, collect the data and configuration information *before* flashing a new firmware version.

Flashing with WinsLoad

IMPORTANT: Before the Scanner 1141 firmware can be upgraded, you must have the WinsLoad software loaded on your PC/laptop and located in its own directory.

Installing WinsLoad

1. Locate the WINSLOAD files on the ScanWin Lite or ScanWin Pro CD, or obtain the **WinsLoad** files from Cameron’s Measurement Systems Division.

- Open Windows Explorer and create a directory on the C: drive of your computer. Name the directory WINSLOAD.
- If the WinsLoad files are unzipped, copy them to C:\WINSLOAD; if the files are zipped, extract the contents of WINSLOAD.ZIP into C:\WINSLOAD. The ZIP file contains five files including the WinsLoad application, two batch files, and two shortcut (PIF) files.

The shortcut files need to be manually put on the desktop

NOTE: The desktop shortcuts assume that c:\winsload is the default directory for the WinsLoad application. If you create the WINSLOAD directory elsewhere in your computer, you must edit the shortcut properties accordingly.

Using WinsLoad

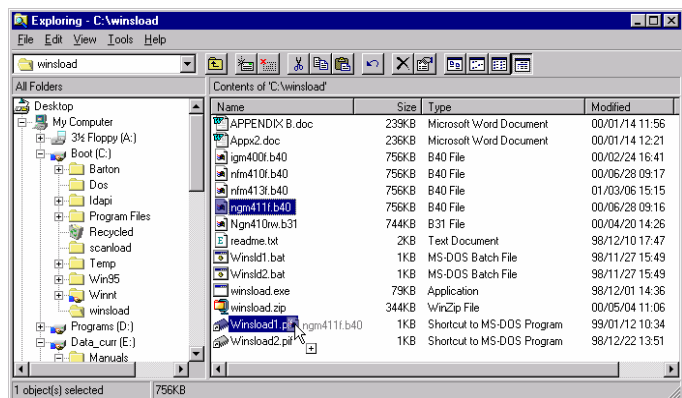
- Using Windows Explorer, drag the binary firmware file icon onto the appropriate WINSLOAD icon (.pif, .bat, or .exe).
 - If COM1** is the communication port on your PC, drag and drop the binary file onto **WINSLOAD1.PIF**, **WINSLD1.BAT** or **WINSLOAD.EXE**
 - If COM2** is the communication port on your PC, drag and drop the binary file onto the **WINSLOAD2.PIF** or **WINSLD2.BAT** icon.

Example: In this case, NGN410R.B31 is being dragged and dropped onto the WINSLOAD1.pif shortcut.

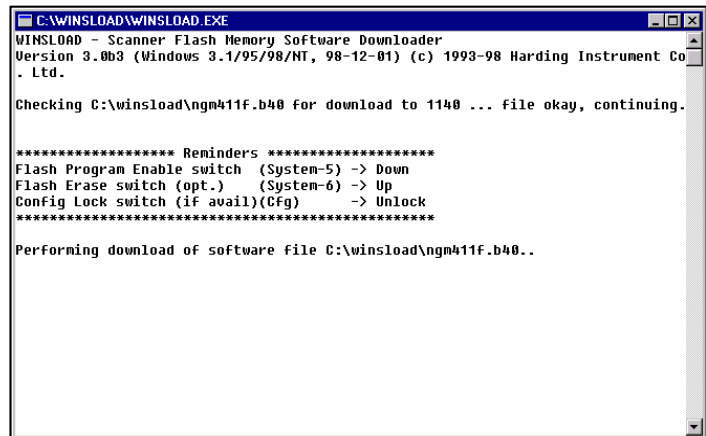
Alternatively, you can use the Win95/98/NT command line. For Windows 3.1, you must use the **Run** command in the Program Manager menu.

The binary firmware filename will be formatted as follows, depending on the firmware version you have:

- NGXXXXXX.B41 for all NGas versions for the Scanner 1141
- NFXXXXXX.B41 for all NFlo versions for the Scanner 1141
- IGXXXXXX.B41 for all IGas versions for the Scanner 1141



- An MS-DOS window is automatically opened. WinsLoad checks the validity of the binary file and if validated, it displays the information shown here.
- Press and hold the Program Erase button while moving SW9 back to the “ON” position to “power up” the Scanner.
- WinsLoad will begin to erase the ROM. When this process is complete, the program will upload the new firmware to the Scanner 1141 while displaying the percentage of the file that has been transferred.
- When the dialog reports “Transmission completed,” close the window.
- Move the *Power* switch (SW9) to the OFF position.
- Superboot the Scanner 1141 RTU as described in the [Startup Procedure](#) on page 55.



```
C:\WINSLOAD\WINSLOAD.EXE
WINSLOAD - Scanner Flash Memory Software Downloader
Version 3.0B3 (Windows 3.1/95/98/NT, 98-12-01) (c) 1993-98 Harding Instrument Co.
. Ltd.

Checking C:\winsload\ngm411f.b40 for download to 1140 ... file okay, continuing.

***** Reminders *****
Flash Program Enable switch (System-5) -> Down
Flash Erase switch (opt.) (System-6) -> Up
Config Lock switch (if avail)(Cfg) -> Unlock
*****

Performing download of software file C:\winsload\ngm411f.b40..
```


MEASUREMENT SYSTEMS

Formerly: NuFlo Measurement Systems • Barton Instrument Systems • Caldon, Inc.

HOUSTON
HEAD OFFICE

281.582.9500

NORTH
AMERICA

1.800.654.3760

ms-us@c-a-m.com

ASIA
PACIFIC

603.2287.1039

ms-asiapacific@c-a-m.com

EUROPE,
MIDDLE EAST
& AFRICA

44.1243.826741

ms-uk@c-a-m.com

USA • CANADA • UK • SCOTLAND • CHINA • UAE • ALGERIA • MALAYSIA • SINGAPORE • www.c-a-m.com/flo

