BARTON®

Scanner® 1131 Measurement RTU

Hardware Manual

Above: Scanner 1131 rack-mount
Right: Scanner 1131S with dual DPE+ units

Manual No. 9A-30165013, Rev. 02

WARRANTY

The Company warrants all products of its manufacture and bearing its nameplate for a period of one year after date of shipment from its factory to be free from defects in material and workmanship subject to the following:

The Company's liability under this warranty is limited in the sole and absolute discretion of the Company to refunding the purchase price, to repairing, or to replacing parts shown to the satisfaction of the Company to have been defective when shipped and then only if such defective parts are promptly delivered to its factory, transportation charges prepaid. This warranty is absolutely void if written notification is not given by Purchaser to Company within one year after said date of shipment.

This warranty applies only if the products have been installed, operated and maintained in accordance with the Company's recommendations and the products have not been misused, neglected, damaged by flood, fire or act of God, or modified or repaired, other than by the Company.

Where the Company has manufactured the products to a design of the purchaser, no liability is accepted by the Company for design errors, which remain the responsibility of the Purchaser.

This warranty is expressly in lieu of all other warranties, obligations, conditions or liabilities, expressed or implied by the Company or its representative. All statutory or implied warranties and conditions, other than title, are hereby expressly negated and excluded. The Company's liability stated herein cannot be altered, enlarged, or extended except in writing by an officer of the Company. The Company shall be under no liability in contract or otherwise for any loss, damage, death or injury arising directly or indirectly out of the supply, failure to supply, or use of the products.

Replacement parts will be invoiced in the regular way with invoices subject to adjustment after the parts claimed defective are examined at our factory. The Company reserves the right to make such changes in details of design, construction of product arrangement as shall, in its judgment, constitute any warranty of the Company's supplier of such products.

The Company and its representatives will furnish, upon request, data and engineering services relating to the application or use of its products. It will not be responsible and it does not assume any liability whatsoever for damages of any kind sustained either directly or indirectly by any person in the adoption or use of such data, any errors or omissions in such data, or engineering services in whole or in part.

WARRANTY LIMITATION

The Company manufactures products which satisfy the exact definition of Quality, that is, they meet the specifications as advertised or as stated by our customer. The products are intended to be used in accordance with the specification and applications described in this document.

A limited warranty applies to Cameron's Measurement Systems Division products. 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 whether or not they are based upon expressed or implied warranty, contract, negligence, or strict liability arising in connection with the design, manufacture, sale use or repair of the products, if they are used outside the constraints of recommended usage as set forth herein.

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, at the above factory address, to the attention of the Marketing Department. 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, please 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, become familiar with the installation instructions presented in Section 1 - Hardware.

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

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

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

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

Please be aware that the above notices appear on the following pages:

- **Page 13**
- **Page 15**
- **Page 102**

REVISIONS

Date	*Description*	*By*
June 1998	Release	A. Seeger, BIL
November, 1999	Major revision	P. Lee, BIL
January, 2000	Minor revisions	P. Lee, BIL
October, 2001	Major revision including new format	P. Lee, BIL
May, 2003	Updated to include the Scanner 1131C	P. Lee, BIL
Oct, 2005	Minor revisions	A. Seeger
September, 2008	Corporate name change	K. Metzer
July, 2010	Updated to show substitution of DPE+ for DPE cell, EB02 modem board option; other minor changes	K. Metzer

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Introduction

Overview

The Scanner® 1131 is an intrinsically safe solar-charged, battery-powered, weatherproof flow computer that calculates flow for two or more meter runs using standard algorithms. It is housed in a metal or plastic enclosure that can be wall or pipe mounted. It is also available in a rack mount style.

The Scanner 1131 provides compatibility between the existing Scanner 1130 enclosure, Scanner 1140 style DPE® units, and 1130 expansion boards. This provides a logical board replacement upgrade path from the Scanner 1130 to the 1131, as numerous enhancements over the 1130 have been made. The expansion board and display connectors are identical to those of the 1130 so that existing keypads, displays, and expansion boards remain compatible.

Twelve single-ended or six differential analog inputs, six status inputs or status outputs or pulse outputs, two analog outputs and up to four serial ports are now available. All input and output channels are user-assignable. Up to 2 expansion boards can be added for additional analog outputs, status input/output channels and serial ports (ASO1, CDO1, CAO1 and DIO1). Optimal expanded memory and math co-processor are available for multiple flowrun applications. There is also an expansion board with serial to Ethernet and Bluetooth (wireless) capabilities.

A PIC16C74 microcontroller processes low level I/O, scans keyboard entry, generates pulse outputs, samples status inputs, and performs the analog conversion to digital of RTD, DPE, and analog inputs.

A keypad, display, and external terminal connector are located on the front of the enclosure. The display shows flow data, operating messages, and operating instructions. The Scanner 1131 is available with an optional backlit alphanumeric display. An auto-scroll feature allows continuous, sequential display of selected flow parameters.

An optional full-keypad is available that allows calibration and most configuration without a terminal. However, a terminal is required for downloading data and information. A terminal is an IBM compatible PC running *ScanPC* or ScanWin™ configuration software. Terminals are connected through an external port (located on the front or bottom of the enclosure) or hard-wired internally.

Compatible input devices include:

- Barton DPE+ cell (pressure and differential pressure in one transducer). The Scanner 1131 can support one or two DPE+ cells. When Barton DPE+ cells are used, both pressure and differential pressure measurements are available from one unit.
- Low power (1-5V) or conventional (4-20 mA) electronic transmitters
- Frequency devices (e.g., turbine meters, or mass meters, etc.)
- Standard 100Ω platinum RTD (temperature) sensors

The Scanner 1131 is intrinsically safe when installed as described in Drawing 9A-1131-11002 (refer to **APPENDIX A: Drawings**) with barriers. Some power sources and input/output devices are not Intrinsically Safe and must be installed to Class I, Division 2 requirements per drawing 9A-1131-11022. Please see installation and wiring sections in this manual for details.

A variety of software programs are available for configuring, monitoring, downloading, retrieving data, reading and creating reports from collected data:

ScanWin™ - ScanWin is a Windows™-based software program that is used to monitor, configure, and download Device Measurement RTU data on-site. Data is displayed graphically and in tables. Reports can also be printed from ScanWin.

ScanPC™ - ScanPC™ is a DOS-based software program for a PC that is used to monitor, configure, and download Scanner data on-site. Scanner files can be printed in a universal report format or output in either comma separated, or tab separated text formats. All report files are readily imported into spreadsheet and database software programs.

ScanBase™ - ScanBase™ is a graphical editing software program that simplifies the management of complex electronic flow data. Months of hourly history can be viewed for trending and analysis. Color codes and Windows point-and-click operations make learning and using the graph, tables, and spreadsheet views easy.

The original flow history is always preserved. Edits are saved with the automatic audit trails, which include a required comment explaining the reason for the edit. Reports and data export functions allow rapid distribution of ScanBase data to other users or interface with other software programs.

1: Installation

Installing the Scanner 1131

CAUTION

POWER TO THE SCANNER 1131 MUST BE TURNED OFF PRIOR TO THE REMOVAL OF ANY ELECTRONIC CIRCUIT BOARDS OR DAMAGE TO THE SCANNER MAY RESULT.

CIRCUIT BOARDS ARE SUBJECT TO DAMAGE IF EXPOSED TO STATIC ELECTRICITY.

HANDLING AND INSTALLATION OF CIRCUIT BOARDS MUST BE PERFORMED IN AN ENVIRONMENT FREE OF STATIC ELECTRICITY AND THE OPERATOR MUST BE GROUNDED.

WHEN CIRCUIT BOARDS ARE REMOVED FROM THE SCANNER 1131, THEY MUST BE PLACED IN PROTECTIVE CONDUCTIVE ENVELOPES.

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

Quick Start

The following chart suggests a sequence for the installation of the Scanner 1131:

Step	*Description*	*Reference Section*
1	Unpack the Scanner	**Page 14**
2	Mounting the flow computer	**Page 14**
3	Connect to pipes	**Page 14**
4	Connect power supply	**Page 14**
5	Flash the Scanner (if changing installed firmware)	**Page 22**
6	Superboot and configure the Scanner Superboot Connect inputs and outputs Configure the EFM/RTU	 **Page 31** **Page 33** See Section 3 of NGas/NFlo/IGas manual or Chapter 2 of the ScanWin manual.

Operating/Storage Limitations

Temperature	The instrument is not to be subjected to ambient or operating temperatures beyond the range listed in the specifications.
Static Electricity	The circuit boards are not to be subjected to any source of external static electricity.

Unpacking

Cameron's Measurement Systems Division Scanners are carefully inspected during manufacturing and before shipment. However, an inspection should be performed at the time of unpacking to detect any damage that may have occurred during shipment. The following items should be included with each shipment:

- Scanner 1131 completely assembled
- Solar Panel and Battery (optional and shipped separately)
- Expansion boards mounted to main board (optional)
- RTD Assembly (optional)
- Integral Transducer(s) (optional)

An IBM compatible PC with ScanPC or ScanWin software is required to configure and collect data from the Scanner 1131. If an Extended Function keypad is installed, the numeric configuration can be done without a PC, however alpha characters must be entered with a PC. A PC is still required to download or upload data even when an Extended Function keypad is installed:

Mounting

A universal 2" pipe mount/wall mount bracket is available. Refer to the section on **Outline Dimensions (page 135)** for size and location.

Piping

All piping connections are made in accordance with standard practices. Consult API 14.3, Part 2 or AGA-3, Part 2 (1991) for additional information.

Power Supply Connection

Conduit entry is provided on the right-hand side of the enclosure for the power supply/solar panel wires. Refer to the section on **Outline Dimensions (page 135)** for size and location of conduit entry and to **Power Supply (page 15)** for power supply connection.

Also, refer to the section on **Main Board and Wiring (page 33)** for additional wiring information and to **APPENDIX A: Drawings** for information about **Hazardous Location** installations.

Power Supply

Class I, Div. 1 Battery Charger / Power Supply

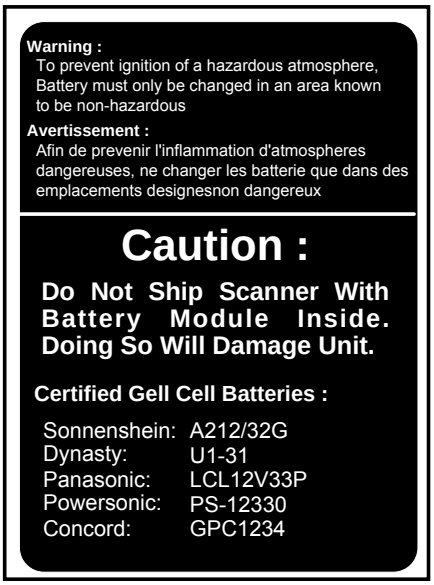
The Class I, Div. 1 battery charger and power supply is designed to charge a 12 V lead acid battery and provide the necessary power to operate the Scanner 1131. (Intrinsically Safe, Class I, Div. 1, Groups C and D, when installed as per **APPENDIX A: Drawings**)

WARNING

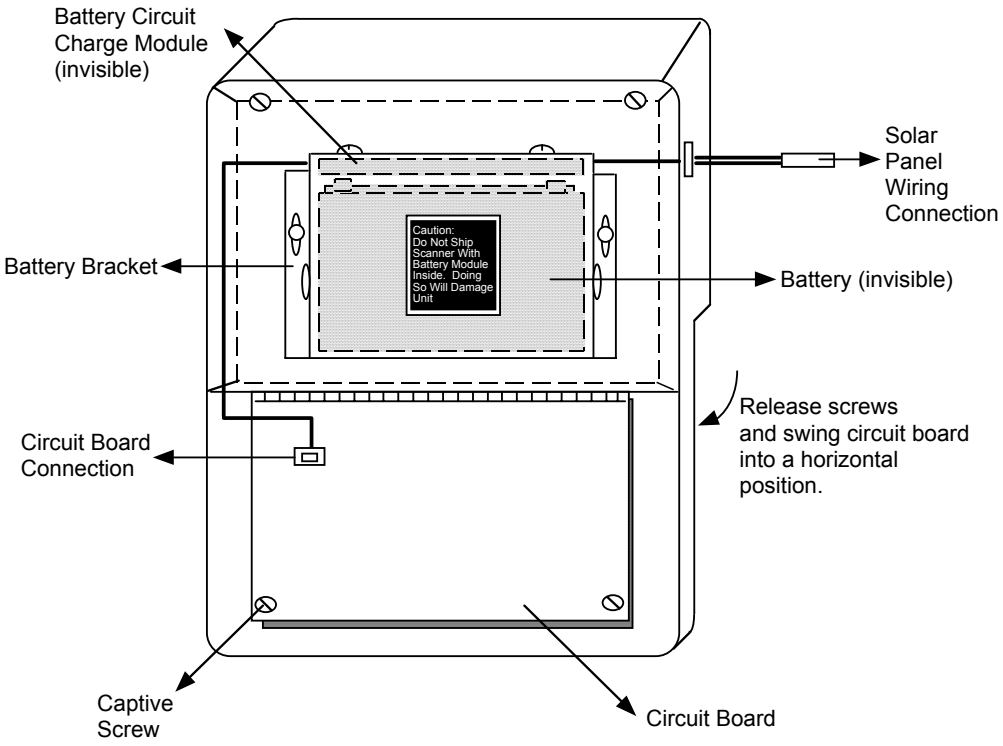
PLEASE HEED THE WARNING LABEL ON THE BATTERY BRACKET. BE SURE TO REPLACE THE BATTERY IN A NON-HAZARDOUS AREA, OTHERWISE THERE IS A RISK OF SEVERE PERSONAL INJURY, DEATH, AND SERIOUS PROPERTY DAMAGE.

CAUTION

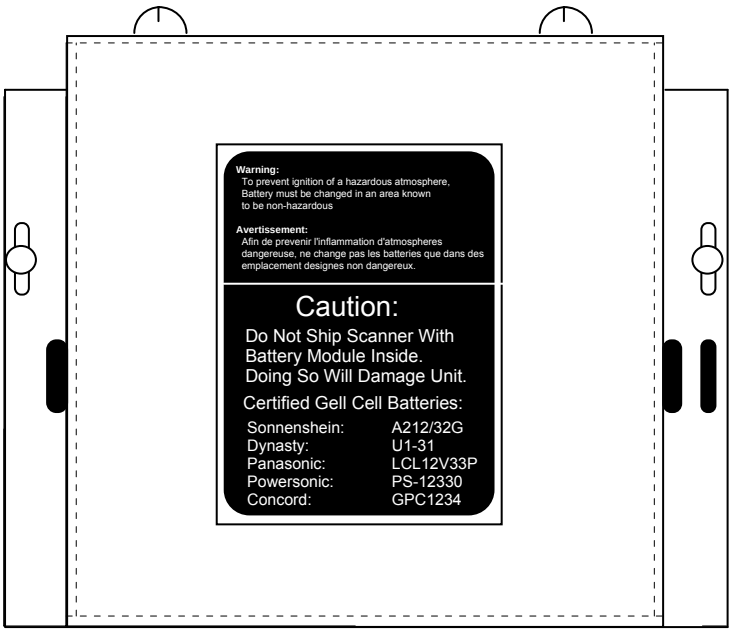
PLEASE OBSERVE THE CAUTIONARY NOTE ON THE WARNING LABEL OF THE BATTERY BRACKET. DO NOT SHIP SCANNER WITH BATTERY MODULE STILL INSIDE THE SCANNER. DOING SO MIGHT RESULT IN DAMAGE TO THE COMPONENTS INSIDE THE ENCLOSURE.



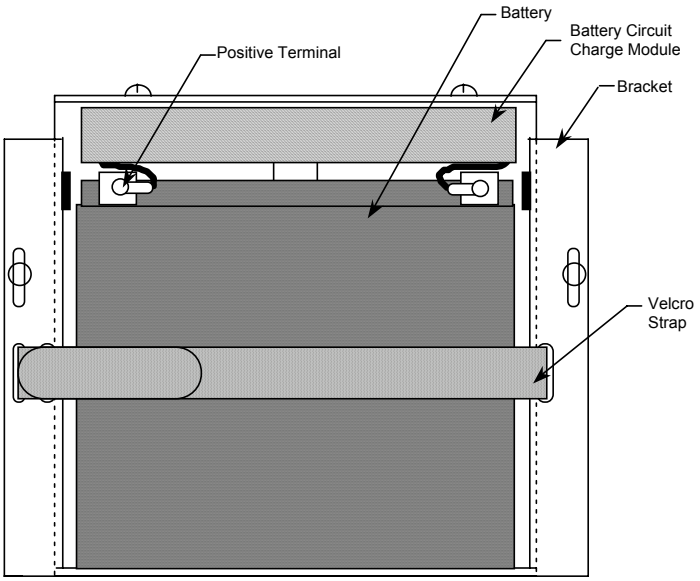
In Class I, Div. 1 instruments, the battery is located behind a cover. To access the battery, loosen the two captive screws at the corners of the main circuit board and tilt the hinged board forward (towards user). In the drawing below, the hinged board is shown fully opened and covering the lower portion of the enclosure. On some enclosures, the hinge is vertical and oriented along the side of the board.



The battery output cable is plugged into a connection on the back of the main circuit board.



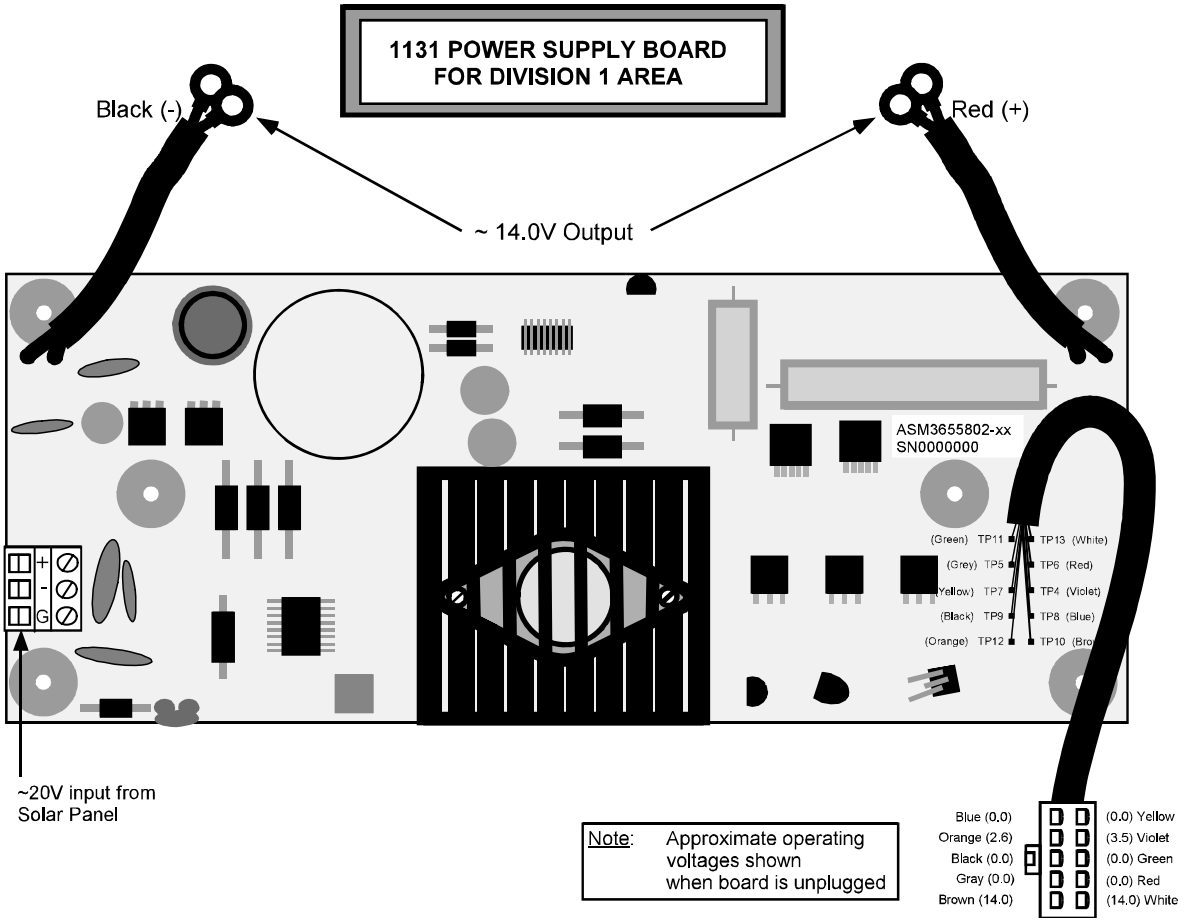
Front View



Back View

The battery should be charged with a 15-28 Vdc supply at 750 mA maximum. **The battery should be disconnected from the charge control module when not in use.** Charge the battery before installing it into the flow computer. If the battery is fully charged, the battery voltage should be over 13 Vdc 30 minutes after the power is removed.

Below is a diagram of the Class I, Div. 1 charge controller / power supply board (Part No. 9A-1131-0301C).



Class I, Div. 2 Power Supplies

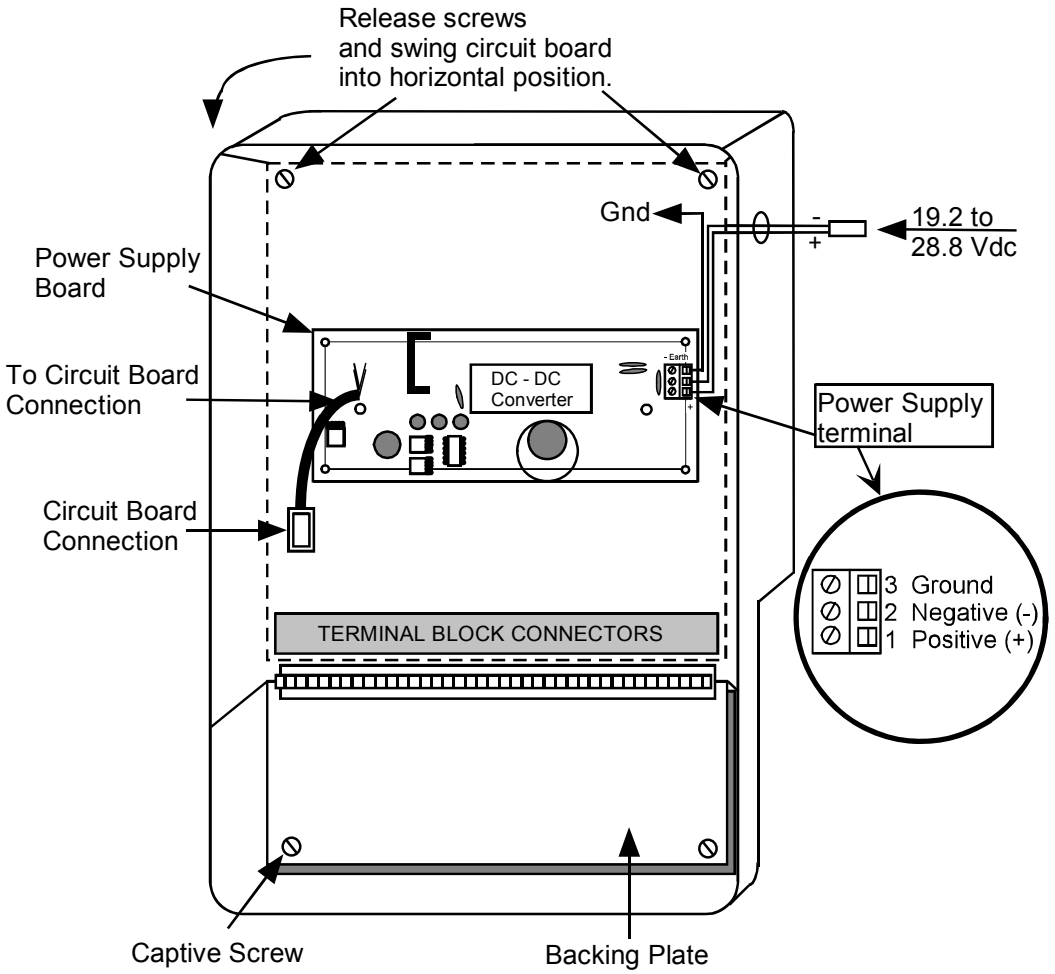
(Class I, Div. 2, Groups A, B, C, D when installed as per **APPENDIX A:** Drawings)

For Class I, Div. 2 instruments, two power supplies are available: a nominal 24-Vdc power supply (19 to 28V) and a 12V battery charger (13 to 28 Vdc).

24-VDC Power Supply

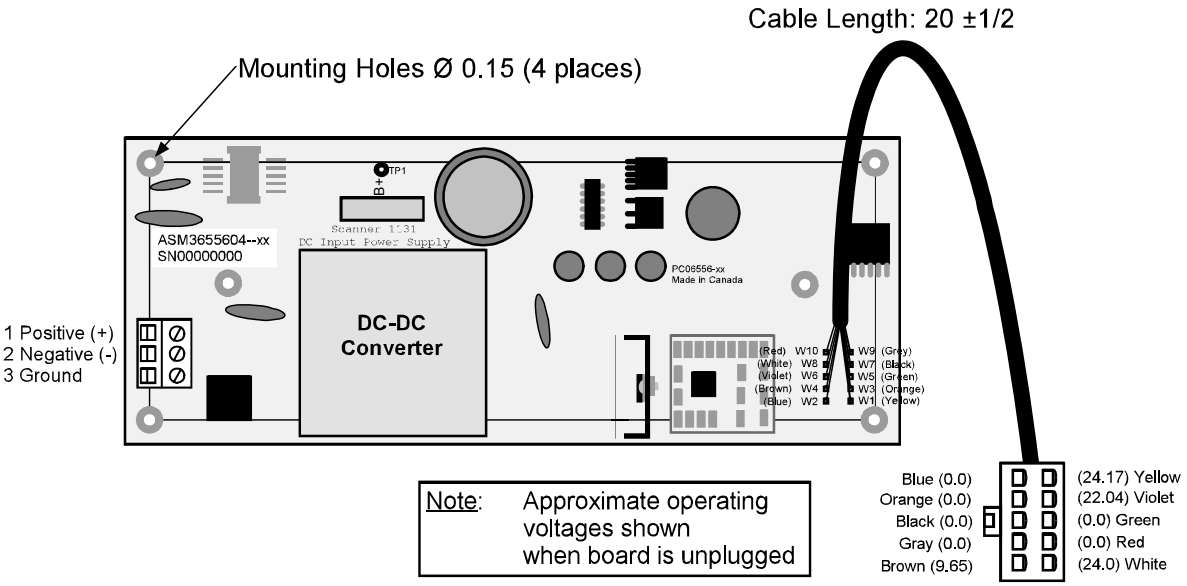
To access the 24-Vdc power supply, loosen the two captive screws at the upper corners of the main circuit board, and swing the board out to access the power supply. This power supply is used in both field mount and rack mount options; for more information on rack-mount installations, refer to the section on **Rack Mount (page 135)**.

The following illustration depicts the setup in a field mount enclosure.



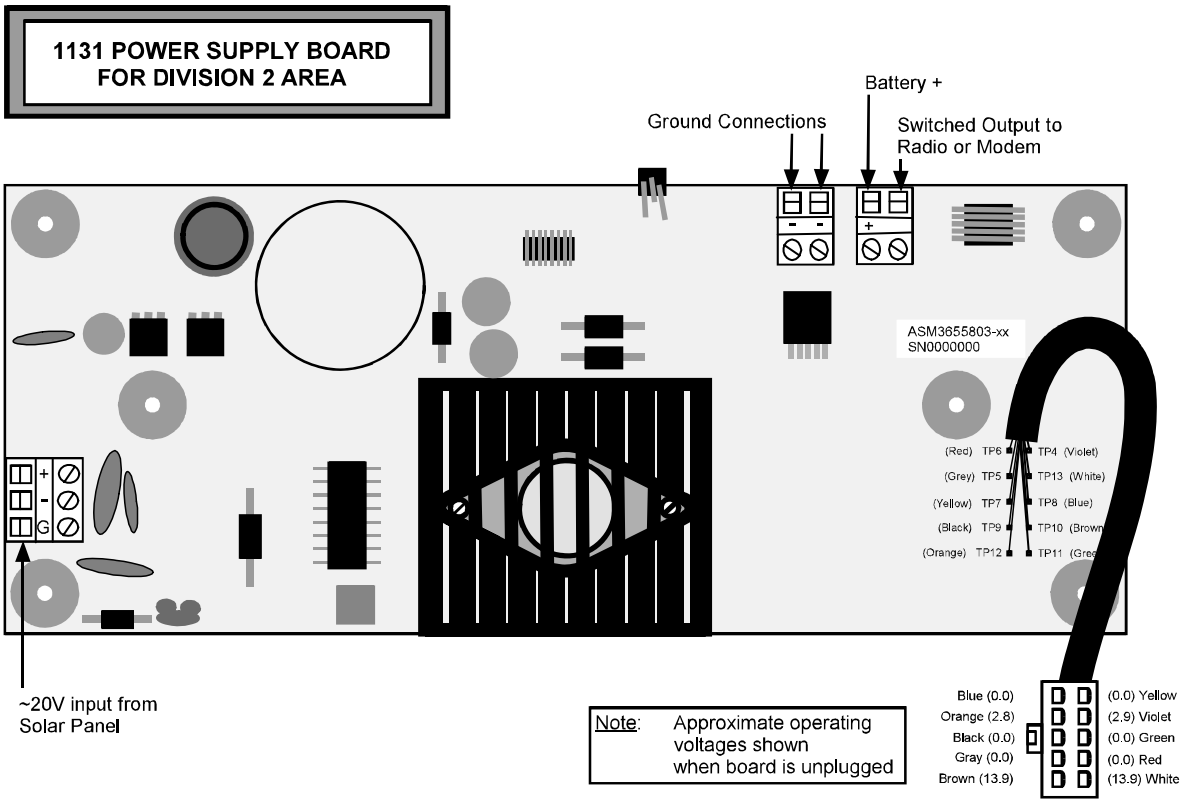
Note: In power save mode, the Vtx is turned ON and OFF.

Below is a diagram of the 24-Vdc Class I, Div. 2 power supply board (Part No. 9A-1131-0304C).



12 Volt Battery Charger

The Class I, Div. 2 battery charger / power supply is mounted behind the hinged main board similar to the Div. 1 charger. The Div. 2 charger has a terminal for connection to the 12 volt lead acid battery and power for a radio or modem. Below is a diagram of the 12-Vdc Class I, Div. 2 battery charger board (Part No. 9A-1131-0302C).



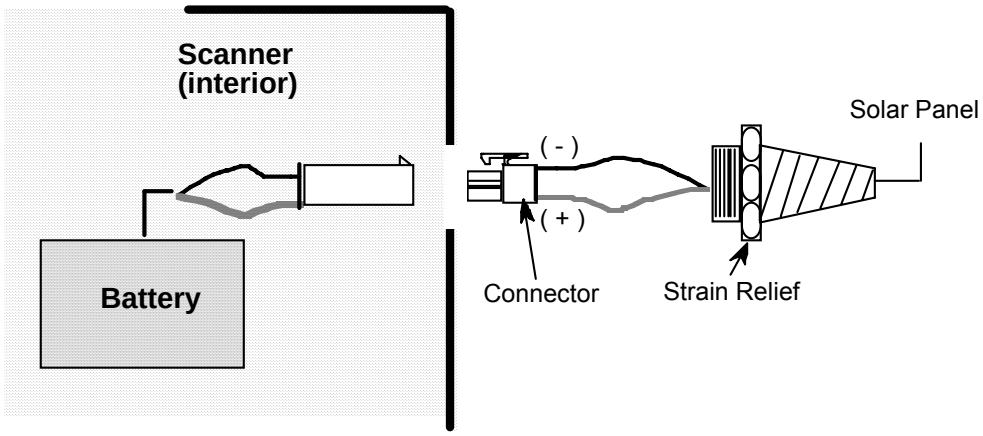
Solar Panel Installation

Mount the solar panel on a post or directly to a south facing flat surface (see chart for angle). The panel should be mounted high enough to prevent damage or tampering. In locations with heavy snowfall, the solar panel is often mounted vertically so snow is less likely to accumulate on the solar panel.

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

Note: Angles are marked on the 10-Watt panel; the 5-Watt panel has 10° notches (0°-90° tilt).

Solar Panel Connection

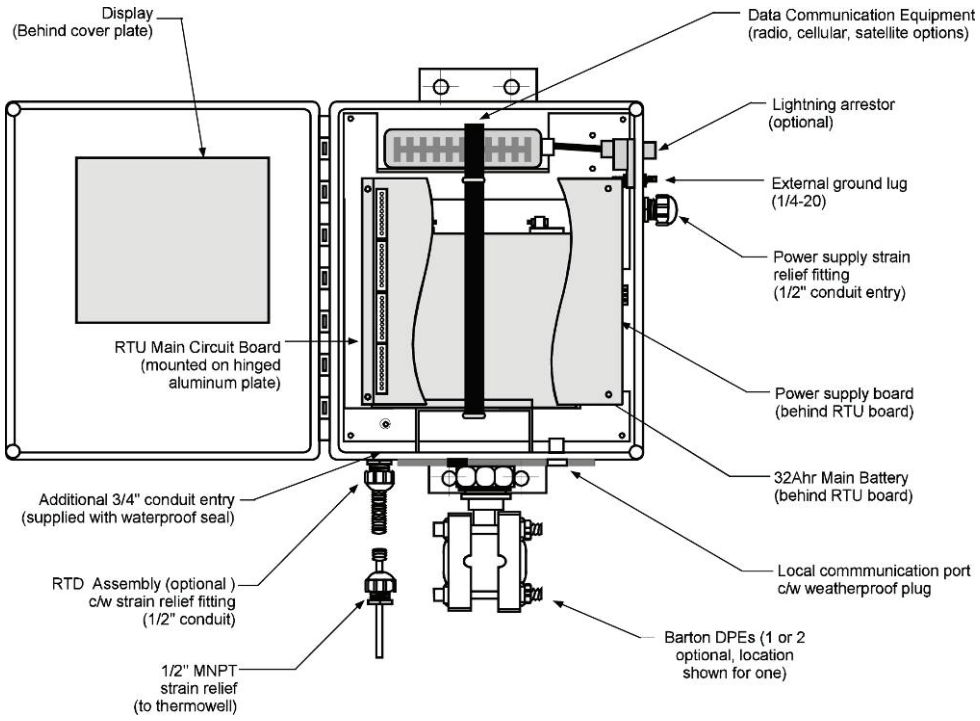


The battery input (charging) cable has a weatherproof strain relief and a quick-release connector that connects the battery to the solar panel's cable.

Enclosure Options

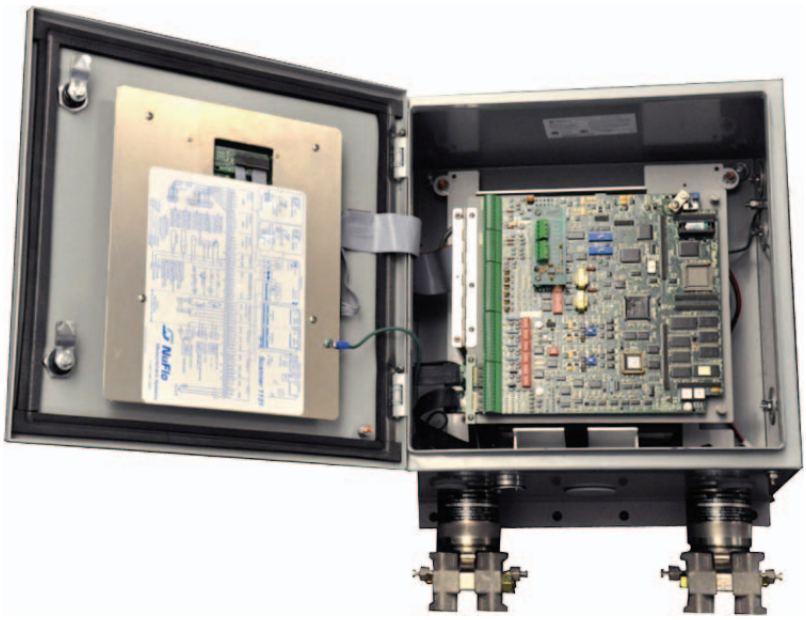
Scanner 1131C

Scanner 1131C is packaged in a NEMA 4 Fiberglass Reinforced Plastic (FRP) enclosure.



Scanner 1131S

The Scanner 1131S is packaged in a NEMA 4 carbon steel enclosure, as shown below with two DPE+ transducers.



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** (**page 29**) may be initiated.

Reprogramming the flash memory of the Scanner 1131 with a new version of firmware requires the use of a loading program. ScanFlash or **WinsLoad**, are utilized in a Windows 3.1, 95, 98, XP or NT environment. Alternatively, if a Windows operating system is not available, **ScanLoad** is a DOS program that should only be run in **DOS** (***NOT*** in a DOS shell from within Windows 3.1, 95, etc.).

If you *must* use ScanLoad, go to **page 27** for information about its installation and use.

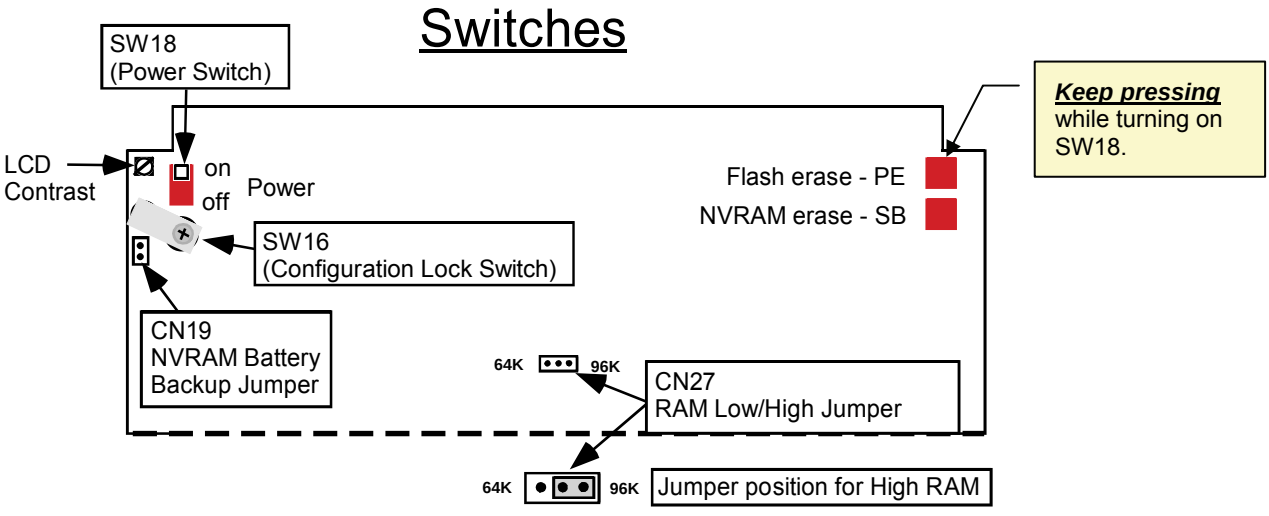
A firmware upgrade is required for all instruments upgraded with a Barton® DPE+ transducer. The table below shows firmware versions required to support the DPE+ transducer.

Selection Chart for Scanner Firmware

If using this firmware	*Install this firmware version (or later version)*	*Configure with this software*
NFlo version 4.x	NFlo 4.4.0R	ScanWin
NFlo version 3.x	NFlo 3.2.4R	ScanPC
NGas version 3.x	NGas 3.1.4R	ScanPC
NGas version 2.x	NGas 2.7.4R	ScanPC

Getting Ready to Flash

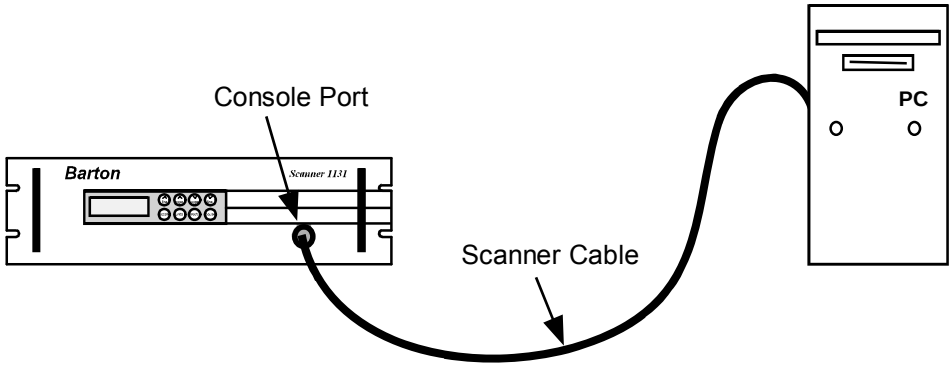
The 1131 Flash Memory enables new firmware to be loaded into the Scanner, using the serial port of a PC. There are no EPROM's to change.



The **Flash Erase** switch, labeled "**PE**" for Program Erase, is located at the top right hand corner of the main board. It is used by the system to initiate the process of re-installing its own firmware. The function is

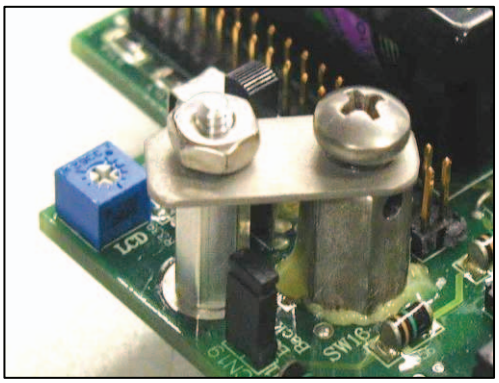
sometimes referred to as "Forced Erase." When the switch is ***pressed and held down*** **<u>while the power is turned on</u>**, the firmware program in the 1131 will be erased.

In order to change the firmware installed in flash memory, a PC with the ScanFlash (or WinsLoad, or ScanLoad) program is required. The PC must be serially linked to the Scanner 1131's console port.

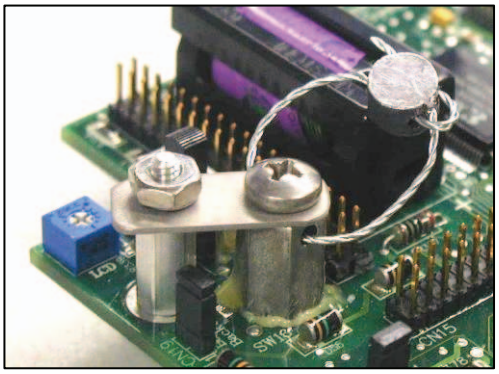


Configuration Lock Switch

The optional Configuration Lock Switch (SW16) may be legally required in some locations. When installed, it is located beside the Power Switch SW18 (see previous diagram). It consists of a locking hardware hex barstock with a spring and screw assembly affixed above a white switch SW16. When the screw is tightened or loosened, it engages or disengages the lock with an audible CLICK. **To flash or to superboot the Scanner 1131 RTU, switch SW16 must be in an UNLOCKED state as is shown below:**



When it is required to be LOCKED, the screw must be tightened until a CLICK is heard. Continue tightening the screw until it is possible to insert the sealing wire through the hex bar stock/screw. Sealed, it looks like the following:



Start Flashing

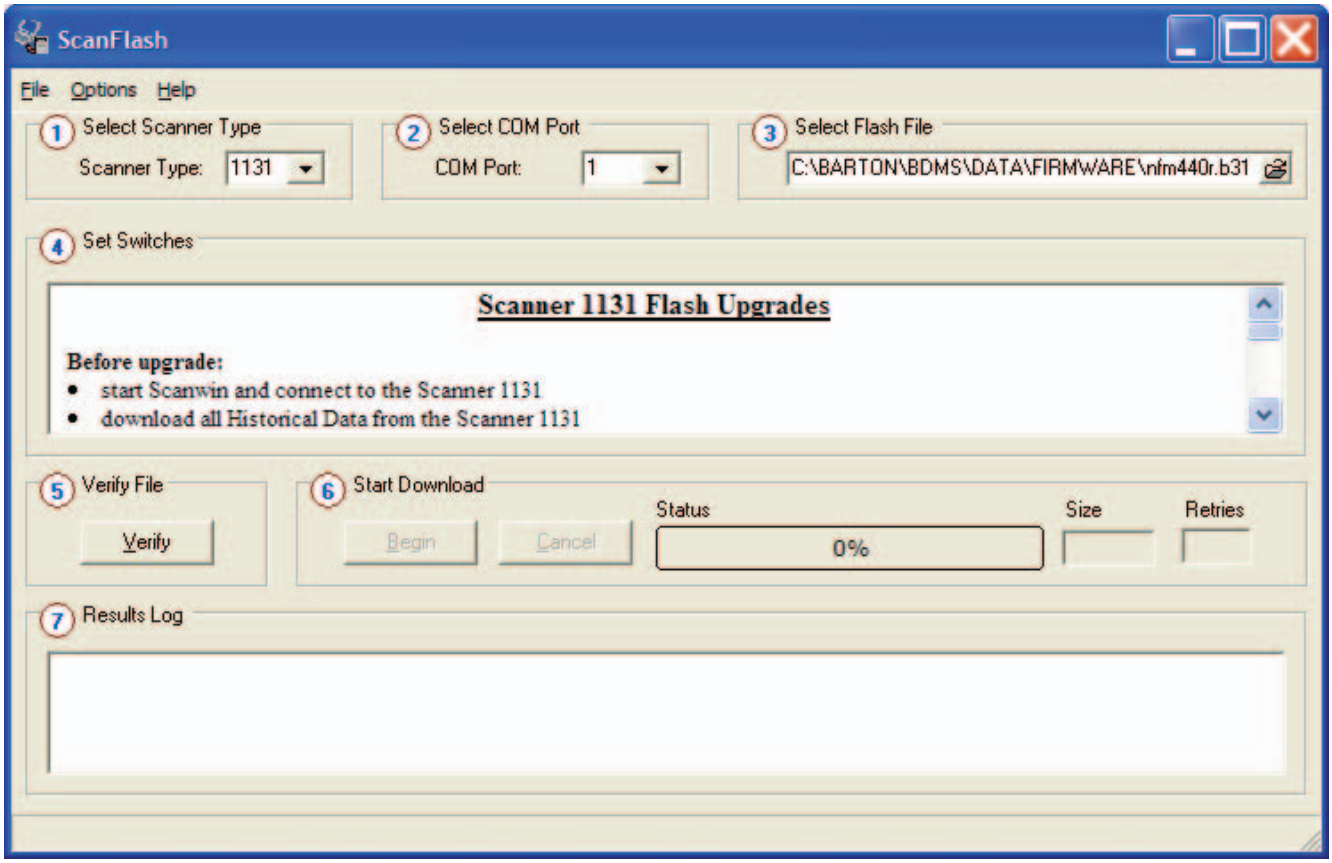
IMPORTANT:	Before the Scanner 1131 firmware can be upgraded, you must have the WinsLoad or ScanLoad software loaded on your laptop in its own directory.

Whether you plan to reprogram the Scanner with either WinsLoad or ScanLoad, carry out the following ***common*** steps, and then go on to the pertinent section.

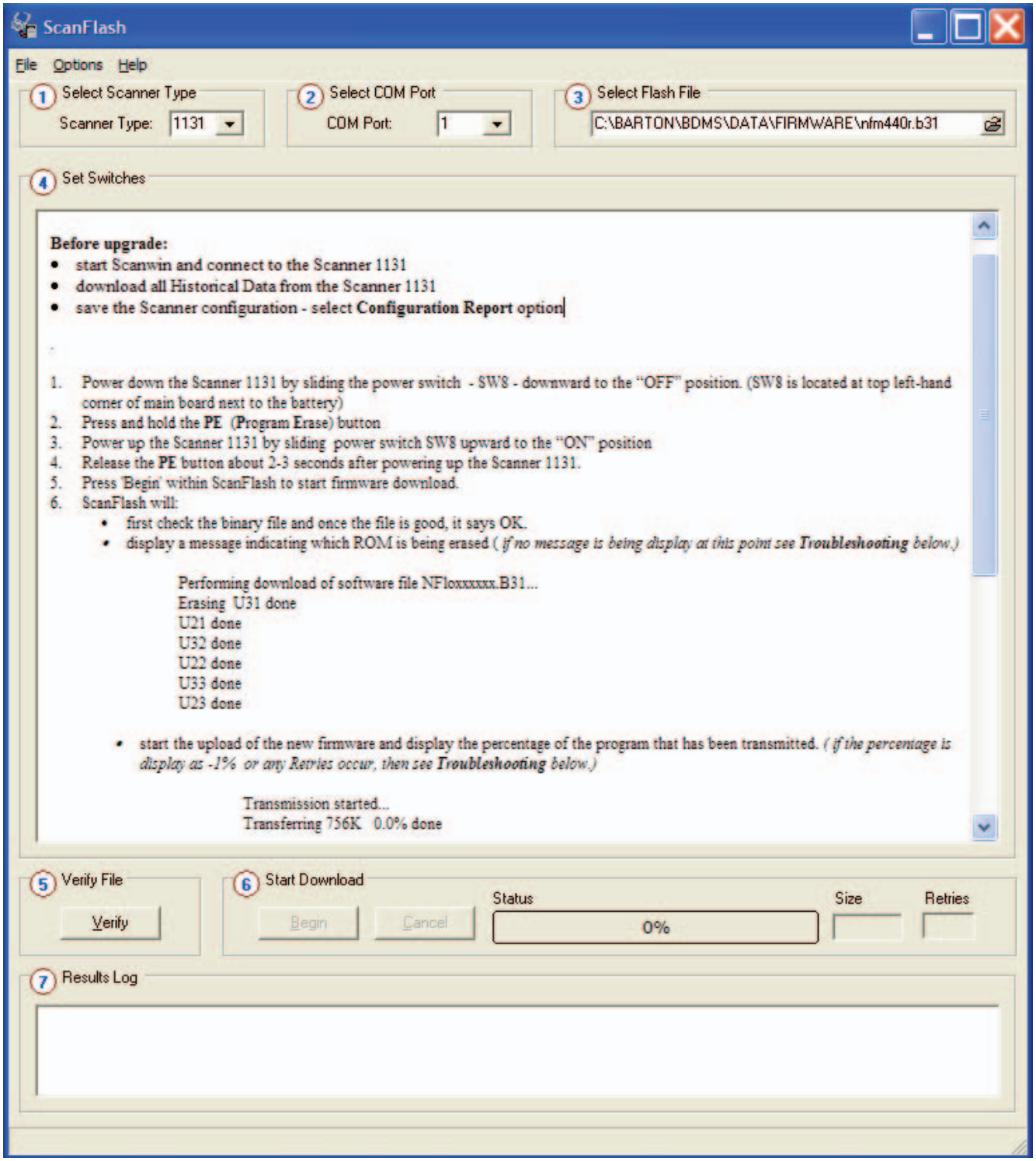
1. Start ScanWin or ScanPC.
2. **Download** all History, Configuration and Calibration data. ***(HIGHLY RECOMMENDED)***
3. Exit from ScanWin or ScanPC.
4. "Power down" the Scanner 1131 by moving Power Switch SW18 to the "OFF" position.
5. Be sure the Configuration Lock Switch SW16 (if installed) is in an UNLOCKED state.
6. Continue in the WinsLoad section below or go to page 27 if you are using ScanLoad.

Flashing with ScanLoad (in Windows)

The ScanFlash utility is loaded on your ScanWin installation CD. Simply load the program onto your computer and follow the on screen instructions



ScanFlash step 4 is Set Switches – The dialog box items 1 thru 4 describe the order for the power and program erase PE switches.



When the status shows 100%, the ScanFlash program can be closed.

Flashing with WinsLoad (in Windows)

WinsLoad can also be used to flash the Scanner RTU using an MS Windows operating system, but it does not have a Windows interface like ScanFlash. If you *must* operate in a DOS environment, go to the section on **Flashing with ScanLoad (DOS) - page 27**.

Installing WinsLoad (MS Windows)

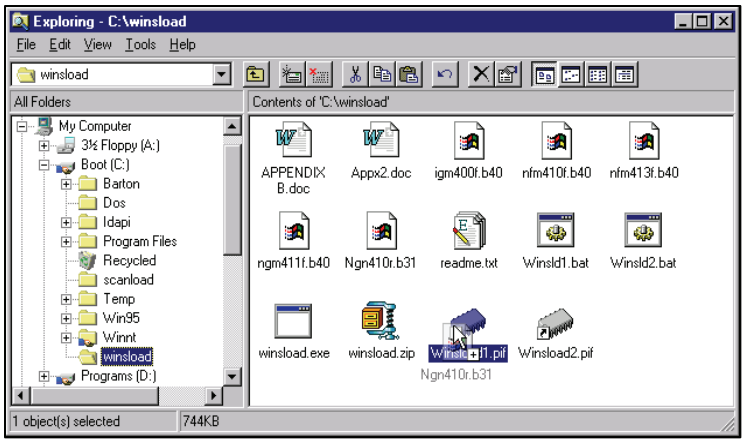
1. Obtain the **WINSLOAD** files from Cameron's Measurement Systems Division.
2. Open Windows Explorer and create a directory named WINSLOAD on the C: drive of your computer.
3. If the files are unzipped, copy them to C:\WINSLOAD; if the files are zipped, unzip the contents of WINSLOAD.ZIP into C:\WINSLOAD. The ZIP contains five files including the WINSLOAD application, two batch files, and two shortcut (PIF) files.

Note: The shortcuts assume c:\winsload as the default directory - edit their properties if you copy WINSLOAD and the two batch files elsewhere.

Using WinsLoad

1. Using Windows Explorer, drag the binary firmware file icon onto the icon of **WINSLOAD1.PIF**, WINSLD1.BAT or **WINSLOAD.EXE** ***if*** **COM1** is the communication port on your PC. The file may also be dragged and dropped onto the WINSLOAD2.PIF or WINSLD2.BAT icon if COM2 is your communication port.

   Example: In this case, note that 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 file name will be formatted as follows, depending on the version:

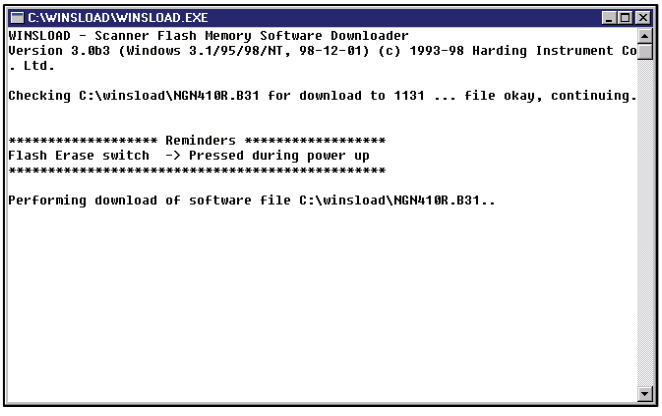
   NGXXXXXX.B31 for all NGas versions for the Scanner 1131

   NFXXXXXX.B31 for all NFlo versions for the Scanner 1131

   IGXXXXXX.B31 for all IGas versions for the Scanner 1131

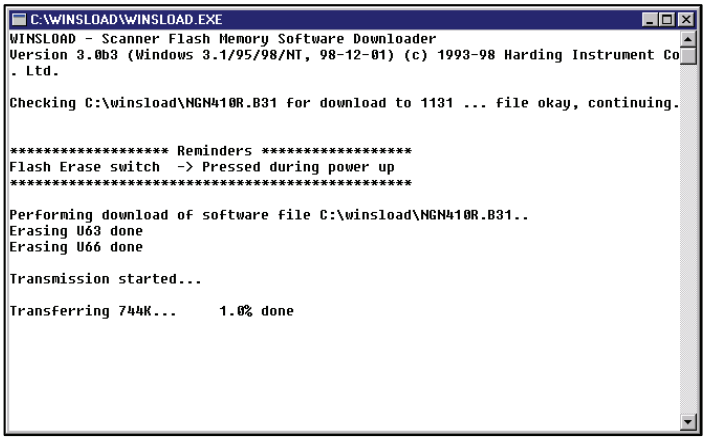
   OPXXXXX.B31 for all OPSat versions for the Scanner 1131

2. An MS-DOS window is automatically opened. WinsLoad checks the validity of the binary file and if it all right, it displays the information shown here.

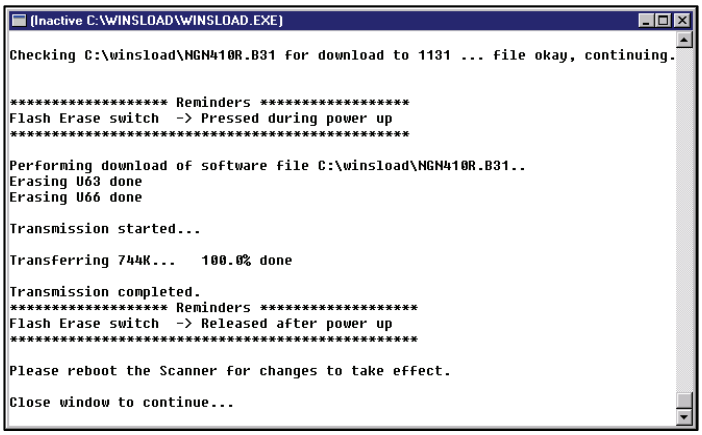


3. Now, "power up" the Scanner by depressing the Flash Erase (**PE**) button and **HOLDING IT DOWN** while you move Switch SW18 back to the "**ON**" position.

WinsLoad begins to erase the ROM. When that is done, it then begins to upload the new firmware to the Scanner while displaying the percentage of the file that has been transferred.



4. When the dialog reports “Transmission completed.”, close the window.
5. Move Power Switch SW18 to the “**OFF**” position.
6. It is **HIGHLY RECOMMENDED** that the Scanner RTU be superbooted. To do this, refer to the section on Startup Procedure (page 29) for instructions about performing a superboot.



Flashing with ScanLoad (DOS)

The use of ScanLoad should take place **only** if you are running in a DOS environment (not from within a DOS “shell” when running Windows). Use WinsLoad if you are operating in an MS Windows operating system.

The **Getting Ready to Flash** section (page 22) should be carried out before using ScanLoad.

Installing ScanLoad Version 2.2

Note: This procedure must be done in a “Safe Area.”

ScanLoad requires the Scanner software as a binary file with the extension .B31. It is recommended that ScanLoad be installed onto the hard drive of the operator’s PC. Running ScanLoad from the hard drive speeds up the downloading process.

To install ScanLoad from disk onto the hard drive perform the following sequence:

1. Turn ON the PC and wait for the C:\ prompt to appear on the screen. If the operator is currently using a program, exit and return to C:\ prompt.
2. Make a ScanLoad directory by typing after the C:\ prompt:

```
md Scanload
```

3. Change the directory by typing after the C:\ prompt:

   `cd Scanload`

4. The following prompt will appear:

   `C:\SCANLOAD>`

5. Copy ScanLoad files EXE., TXT., and binary (B31) from the A drive to the hard drive by typing:

   `Copy a:*.*`

   (This will copy all the files that are on the disk, including the binary file) to the ScanLoad directory.

   To copy ***ONLY*** the ScanLoad files, type the following after the `C:\SCANLOAD>` prompt:

   `Copy a: SCANLOAD.*`

   (This will copy only the ScanLoad.EXE and TXT files from the disk.)

   The binary files must then be copied by typing:

   `Copy a: [binary name]`

   after the `C:\SCANLOAD>` prompt. (An example of a binary name is `NGS260F.B31)`.

Using ScanLoad

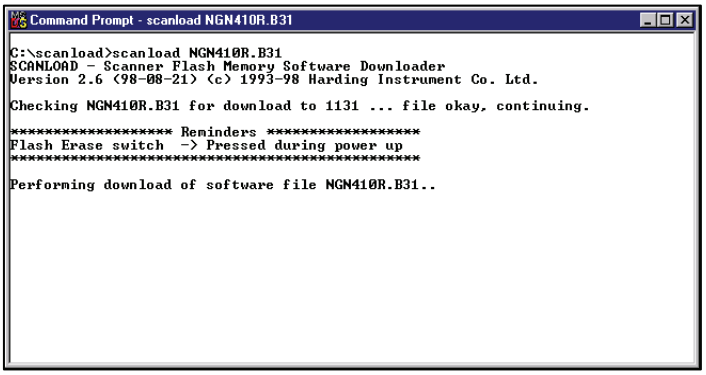
Before starting ScanLoad, perform the steps outlined in the **Getting Ready to Flash** section, **page 22**.

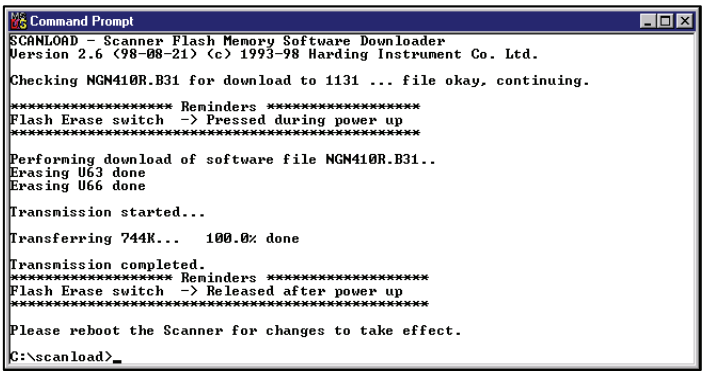
1. From the ScanLoad directory, type: **SCANLOAD NGN410R.B31**, then press <***ENTER***>. SCANLOAD is the executable file that starts the program and NGN410R.B31 is the binary file with the new firmware. ***Note that a newer binary file would have a different name***.
2. ScanLoad checks that the binary file is a valid one, and informs you that it is ready to download the file.
3. "Power up" the Scanner 1131 RTU by depressing the Flash Erase (**PE**) button and keep **HOLDING IT DOWN** while you move Power Switch SW18 back to the "**ON**" position. This will start the process of erasing the old firmware.

   ScanLoad will:

   - display a message indicating which ROM is being erased (if no message is being displayed at this point see **page 29 - Troubleshooting the Flashing Procedure** section of this chapter).
   - start the upload of the new firmware and display the percentage of the program that has been transmitted. (If the percentage is displayed as -1% or, if any Retries occur, then see the **Troubleshooting the Flashing Procedure** section (**page 29**).

   These messages are displayed in the following manner:





4. As instructed close the window.
5. "Power down" the RTU by moving switch SW18 to the "**OFF**" position.
6. You are now ready to superboot the Scanner as it is explained in the

Superbooting the Scanner section (refer to **page 31**).

Troubleshooting the Flashing Procedure

- In WinsLoad, abort the flashing process by clicking on the ***Close*** button (***X***). Or, in ScanLoad, press both the ***Ctrl*** and ***Break*** keys.
- Power down the Scanner 1131 as described in **Step 4** of the **Start Flashing** section (**page 24**).
- Restart the loading program as explained in **Step 1** of **Using WinsLoad** or **Using ScanLoad**.
- Power up the Scanner 1131 as in **Step 3** of either **Using WinsLoad** or **Using ScanLoad**.

Startup Procedure

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

CN19 – The NVRAM Battery Backup jumper **must** be across the pins.

CN27 – The RAM Jumper should be set, for ***more than three*** flowruns, to **128K** with ***firmware 4.3.x and above*** (**96K** when using ***earlier*** firmware versions). Superboot required for change in jumper position to take effect.

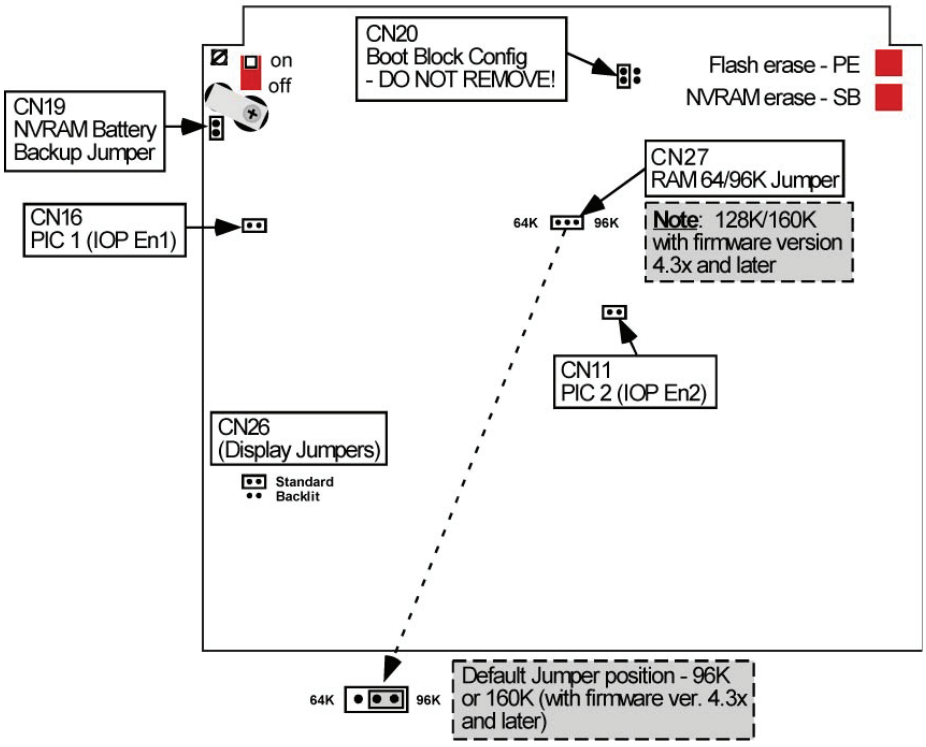
CN16 and **CN11** – The PIC1 and PIC2 Jumpers should be across the pins for normal operation.

CN26 - The Display Jumper may be for standard or backlit (if so equipped).

For a Standard display ASM 172050102, p/n 9A-1131-0403C the jumper must be in the backlit position. (The ASM number is printed on a yellow sticker on the display)

Jumper Settings

Jumpers


CN20
Boot Block Config
- DO NOT REMOVE!
Flash erase - PE
NVRAM erase - SB
on
off
CN19
NVRAM Battery
Backup Jumper
CN16
PIC 1 (IOP En1)
CN27
RAM 64/96K Jumper
64K
96K
Note: 128K/160K
with firmware version
4.3x and later
CN11
PIC 2 (IOP En2)
CN26
(Display Jumpers)
Standard
Backlit
64K
96K
Default Jumper position - 96K
or 160K (with firmware ver. 4.3x
and later)

Superbooting the Scanner

Note: If the Scanner has been *FLASHED* or is *NOT CONFIGURED*, perform a ***Superboot***. If it is already configured, it is not necessary to perform a superboot. Also, note that if a previous configuration was saved, it is possible to restore a configuration after a Superboot is performed.

After power has been applied to the unit for the first time, it is always recommended to perform a **SUPERBOOT** to initialize the memory. This procedure is explained in this section.

Perform a ***Superboot*** as follows (refer to the diagram on **page 34** for the locations of the switches):

1. Set the ***Power Switch*** (SW18) to **OFF**.
2. Ensure that the ***Configuration Lock Switch*** (SW16) is NOT engaged (see **page 23**).
3. Press the ***NVRAM Erase*** (**SB**) button and **keep it held down**.
4. Set the ***Power Switch*** (SW18) to the **ON** position ***while still holding down the NVRAM Erase button*** **until the display shows:**

```
Superboot found
resetting unit
```

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

CAUTION:
Superbooting causes a ***LOSS*** of Configuration and History data.
SAVE all Configuration and History data ***BEFORE*** superbooting the Scanner RTU.

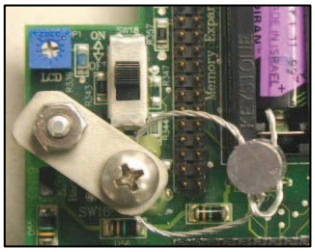
5. When the display shows the first message (**Superboot found…resetting unit**), it is safe to release the ***NVRAM Erase*** (**SB**) button. This will take approximately 10 seconds.

   Note: If the NVRAM Erase button is released before the display shows the "**Superboot found…**" message, the unit may ***not*** function properly due to an incomplete superboot.

6. Start ScanWin or ScanPC and set the time and date at the prompt.
7. If it is necessary to add ***new hardware*** to the Scanner RTU, disconnect or switch off input power to the Scanner. Proceed to connect the transmitters, RTD's and other end devices (refer to **page 33 - Major Chips**). If the end devices include turbine meters or other pulse output meters connected to A05 and A06, ensure that SW9 and SW10 are set to the appropriate mode. When you are finished, connect or turn on input power to the Scanner.
8. ***Configure*** the scanner (Refer to the ScanWin manual Chapter 2 – (Overview of the Startup Procedure) **or** Section 3.2 – Scanner 1100 Configuration NGas/NFlo X.X.X).

   Note: It is **recommended** that the new Scanner configuration be rebuilt in its entirety. Undesired problems may result when a configuration file built in one firmware version is uploaded to another Scanner with a different firmware version.

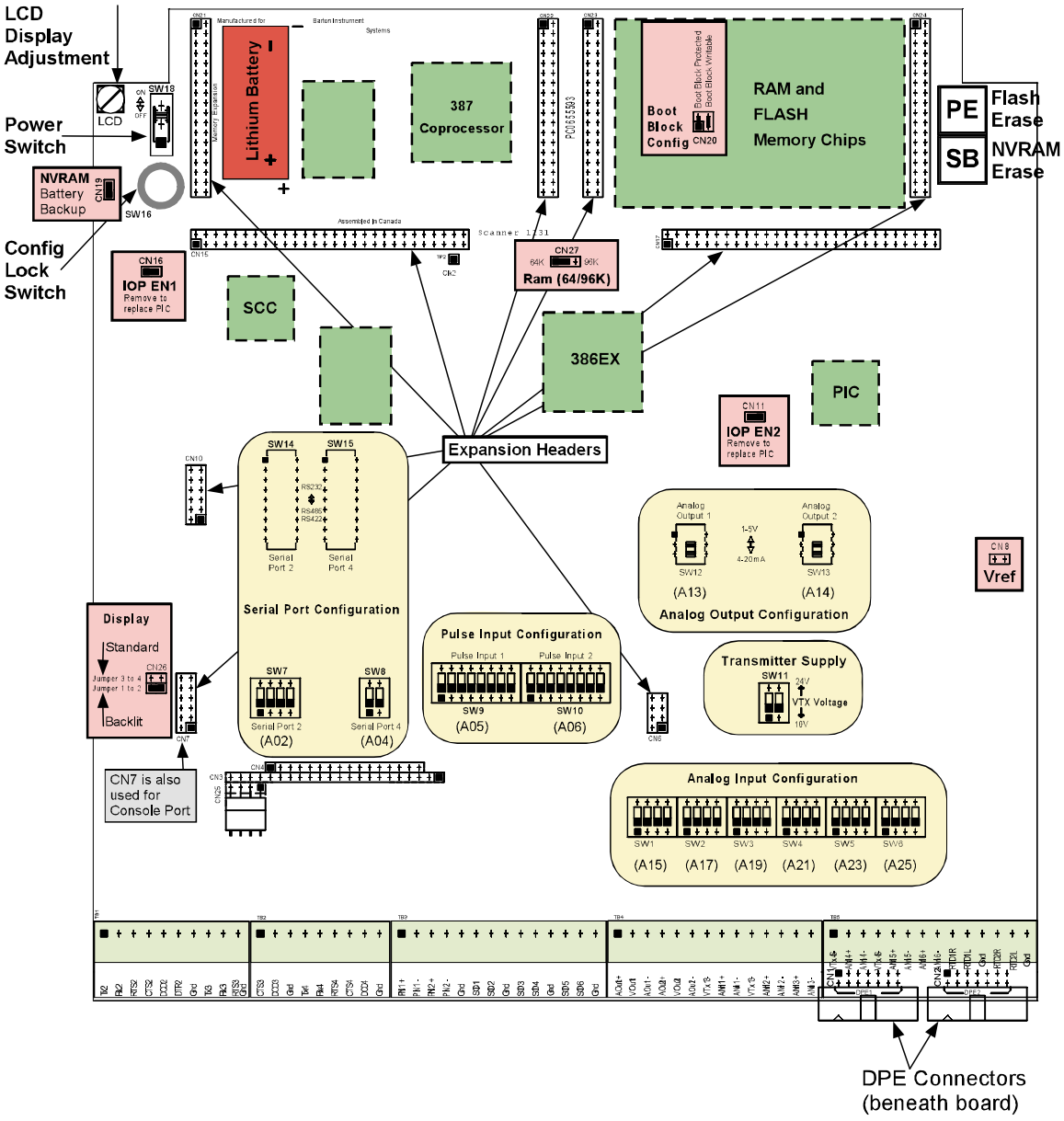
9. Where legally required, the Configuration Lock Switch (SW16) may be enabled and sealed.



2: Main Board and Wiring

Main Circuit Board's Major Components

The following diagram outlines the locations of major chips, jumpers and switches.



Major Chips

The preceding diagram shows the major chips as green rectangles bordered by dashed lines.

Jumpers

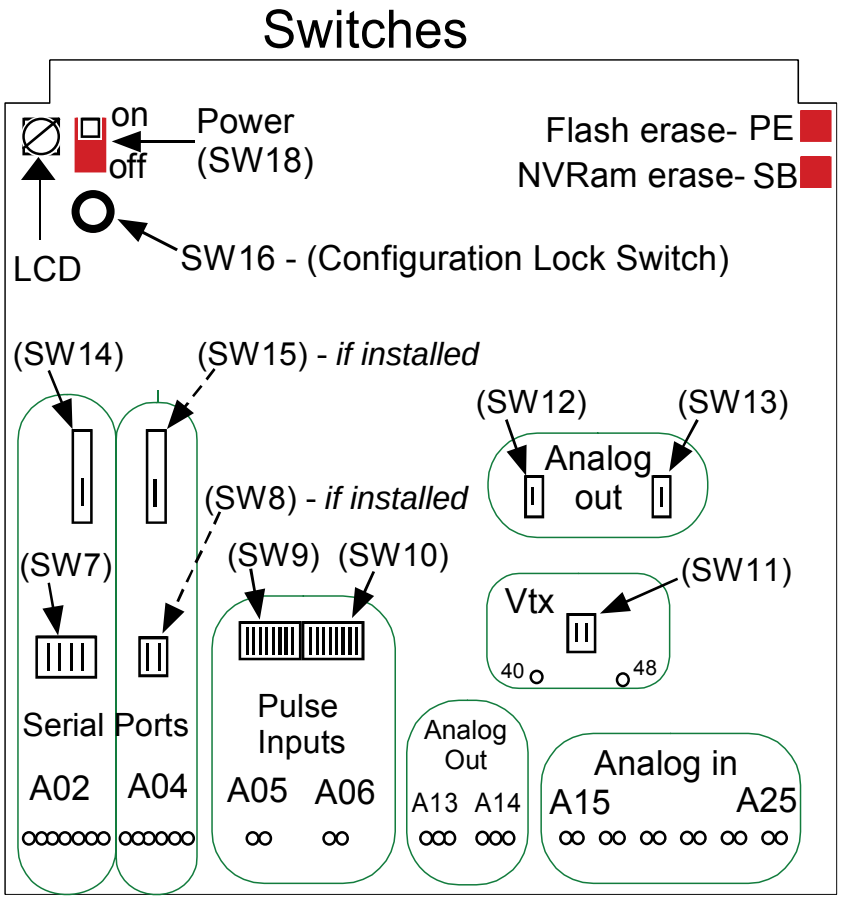
The preceding diagram shows the locations of jumpers in a pink rectangle bordered by a solid line. Refer to **page 29** for an **important note** regarding the jumper settings.

Switches

The Scanner 1131 contains switches for the following:

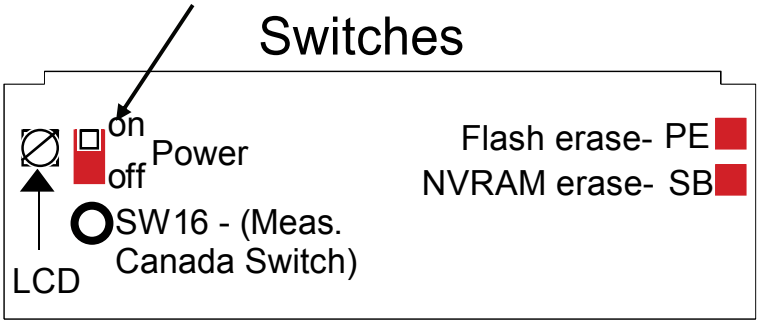
- Power (on/off)
- NVRAM Erase (SB)
- Flash Erase (PE)
- VTX to select power to transmitters
- Analog input configuration
- Analog out configuration
- Pulse (frequency) input configuration
- Serial port configuration

The following diagram shows the relative positions of these switches.



Power Switch

The power switch located at the upper left-hand corner (or the front right-hand corner on the 1131 rack mount) of the main circuit board. To turn the unit off, place the Power Switch in the **OFF** (down) position.



To turn the unit on, place the Power Switch in the **ON** (up) position. This causes a **Power on restart.** The Power on restart interrupts the flow calculations, but does not affect the configuration or historical data. The display will show:

```
Power on restart
```

The NVRAM Erase Switch

Holding down the **NVRAM Erase** (SB) button (see **Superbooting the Scanner – page 31**) effectively erases all configuration and flow data when the power is turned ON.

The Flash Erase Switch

The **Flash Erase** (PE) button is used to erase the firmware program installed on the Scanner. Refer to the **Getting Ready to Flash** section on **page 22**.

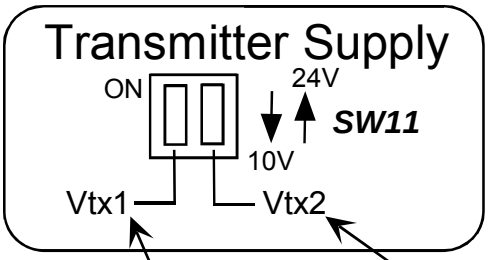
Transmitter Power Supply Switch (to Vtx)

The Transmitter Power Supply Switch, **SW11** (located on the main board and detailed below), is comprised of two banks of switches. The first (named **Vtx1** in the diagram below) controls the output to terminal **40 & 43**, and the second named **Vtx2**, controls the voltage to terminal **48 & 51**.

When using a 12 Vdc battery charger/power supply (**page 121**), the transmitter supply output to terminals 40 and 48 is always 10 V, regardless of the switch settings.

If a 24 Vdc isolated power supply (**page 124**) is installed, the output to the Vtx1 and Vtx2 is switch-selectable between 10 V and 24 V, as shown in the diagram.

Note: See **Total Transmitter Supply Output** below for more information.



Boards	Vtx1 Switch controls	Vtx2 Switch controls
Six Analog	Vtx1-3	Vtx4-6
Twelve Analog	Vtx1-6	Vtx7-12
	Output to terminal 40 & 43	Output to terminal 48 & 51

Total Transmitter Supply Output

Vtx10 is defined as the supply output for turbine preamplifiers and inductive proximity sensors.

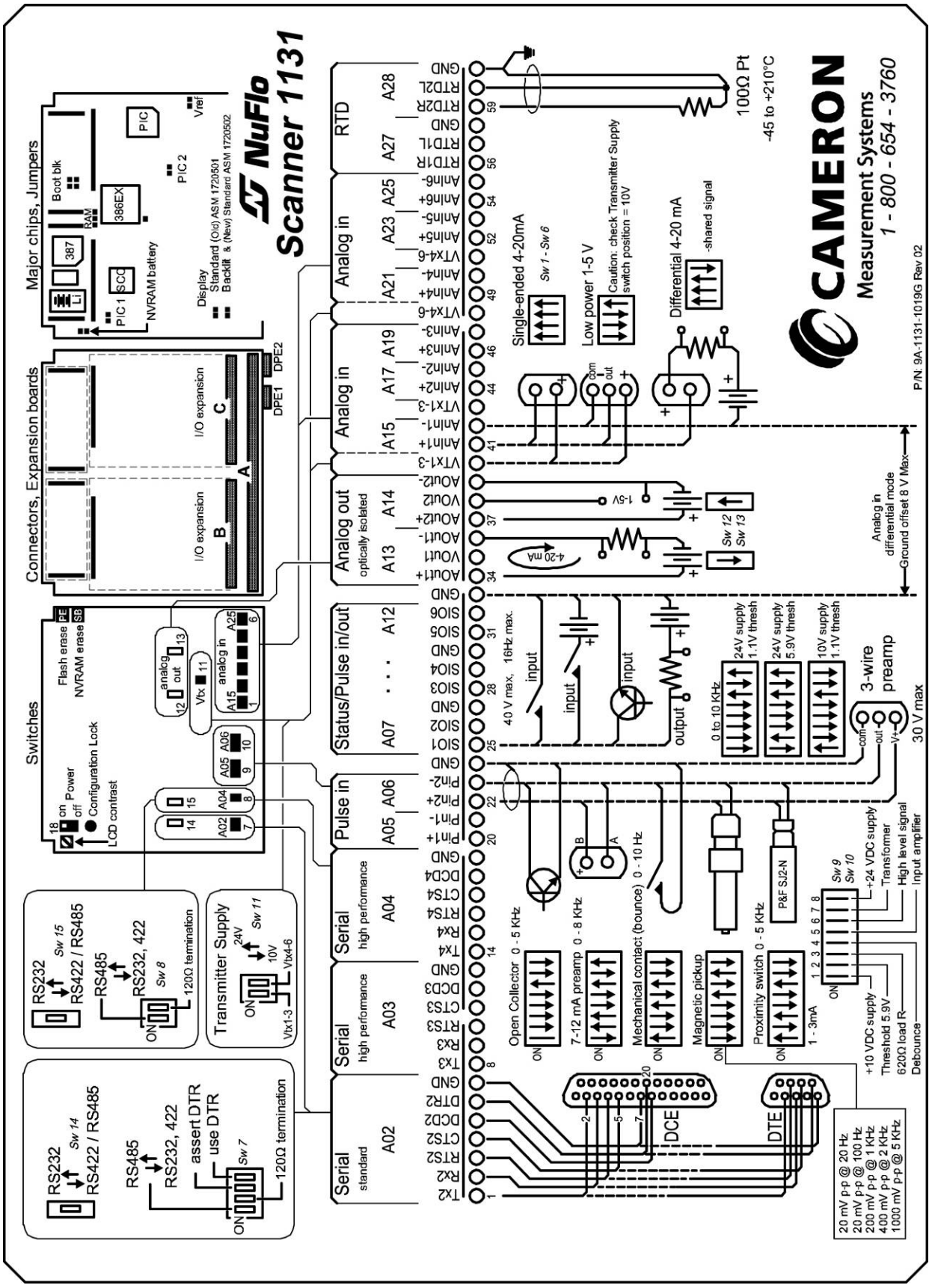
If **10 V** are being produced, the ***TOTAL*** transmitter supply output to Vtx1, Vtx2 and Vtx10 is **15 mA**.

If ***24 V*** are being developed, the total to these three outputs is ***240 mA***

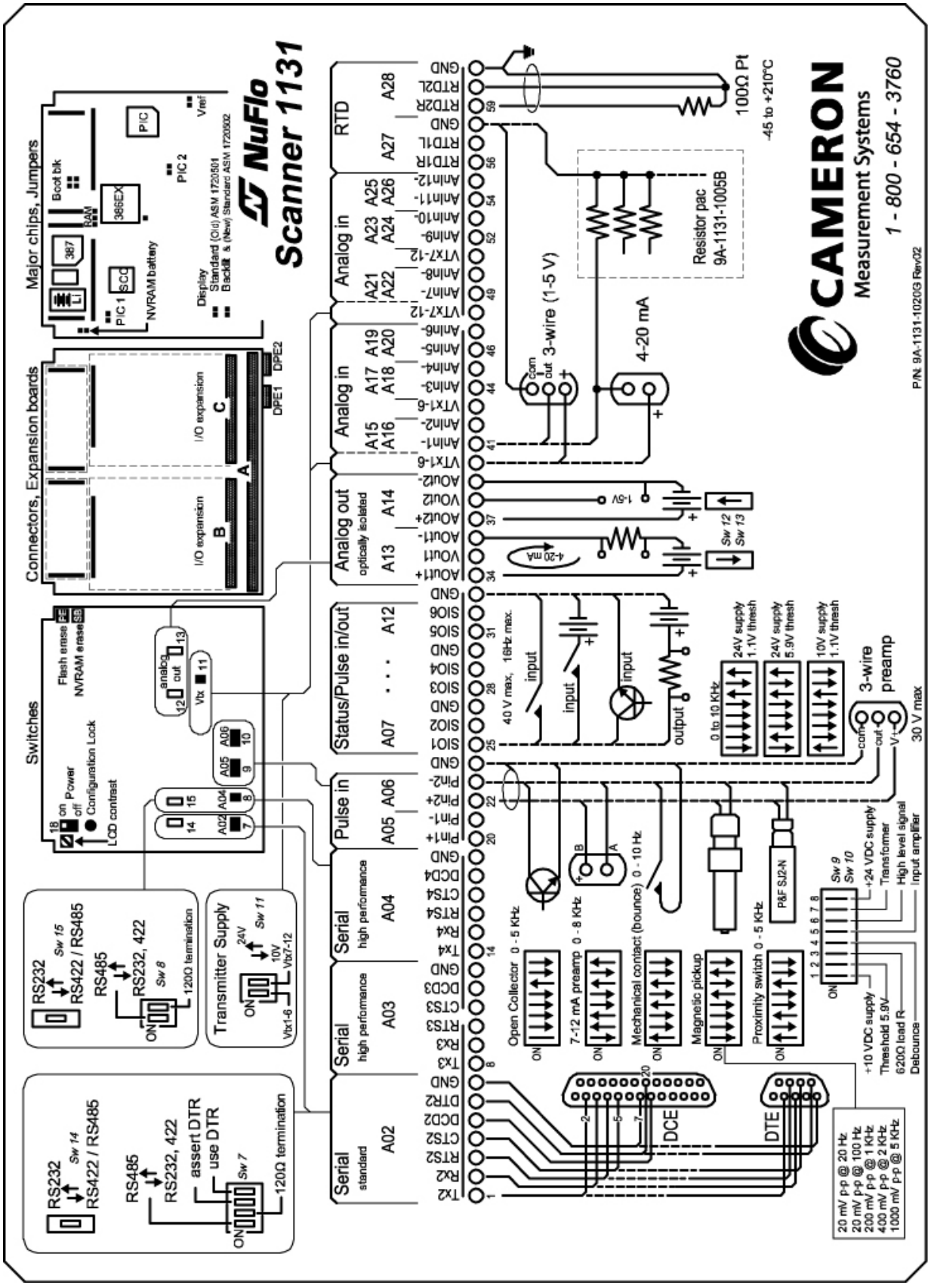
Main Board Wiring Diagrams

See pages **37** (Six Analog Board) and **38** (Twelve Analog in Single-ended Board).

Six Analog Board



Twelve Analog in Single-Ended Board

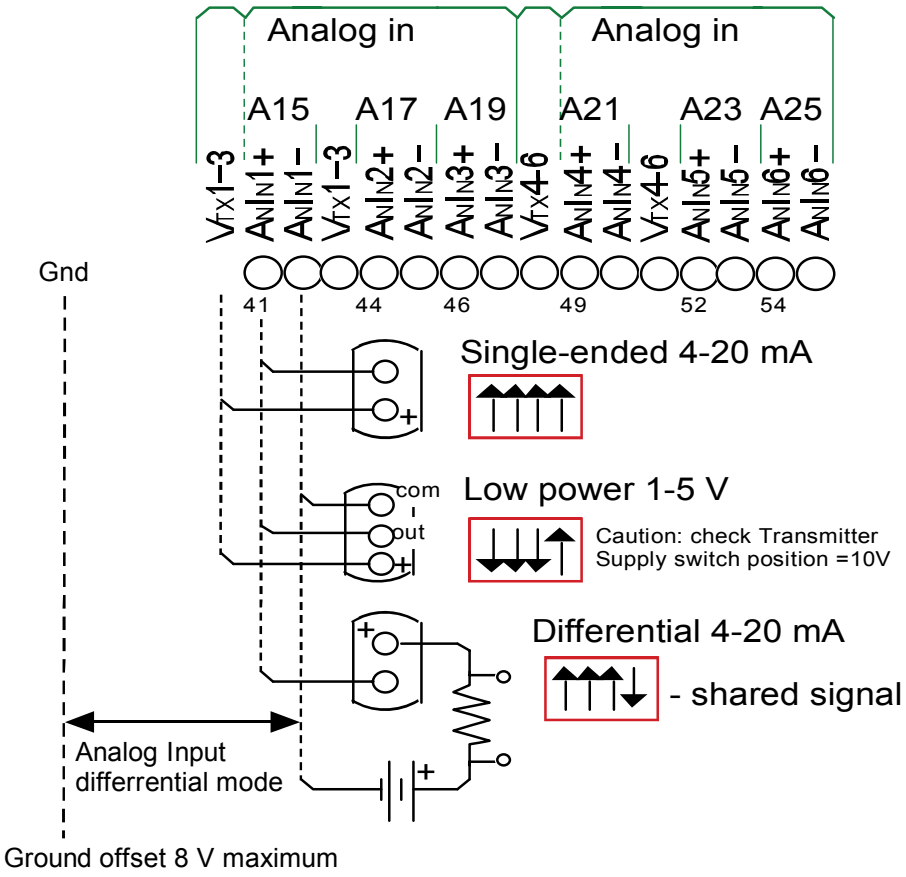


Analog Transmitter Inputs

The Scanner 1131 (10 V, 15 mA) is available with two analog input options.

Six Analog Input Option

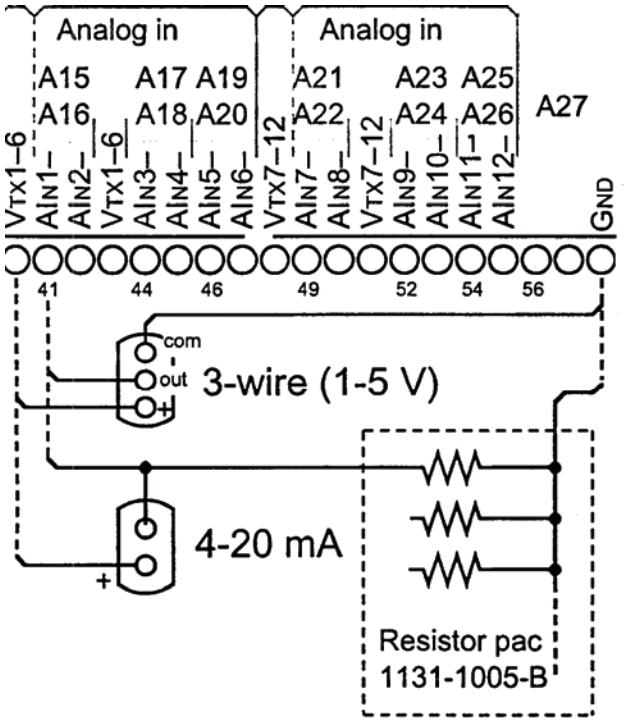
Six Differential or Single-ended inputs (see section on **Order Code (page 131)** for main board options) is an option that provides the capability to select either differential or single-ended connection of analog transmitters. It also provides the ability to enable or disable, via DIP switches, the on-board 250Ω precision load resistors.



Note: The **TOTAL** +10 V transmitter output (e.g. Vtx10, Vtx1-3 **and** Vtx4-6) is 15 mA.

Twelve Analog Input Option

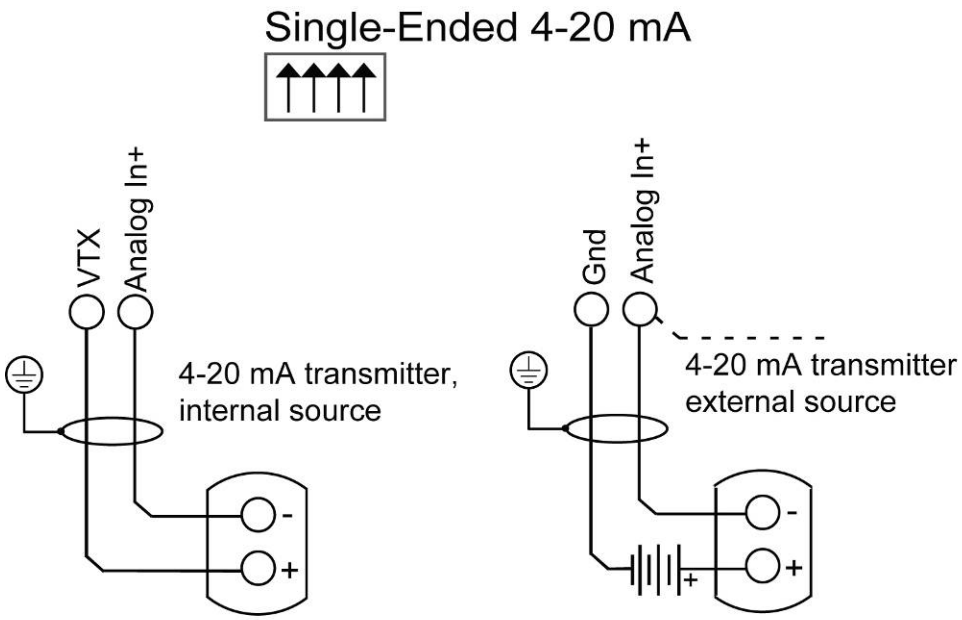
This option requires the addition of the 9A-1131-1005-B 250Ω precision resistor pack for use with conventional 4-20 mA transmitters. The resistor pack is usually located beneath the main board's terminal blocks (from about terminal 35 to terminal 58).

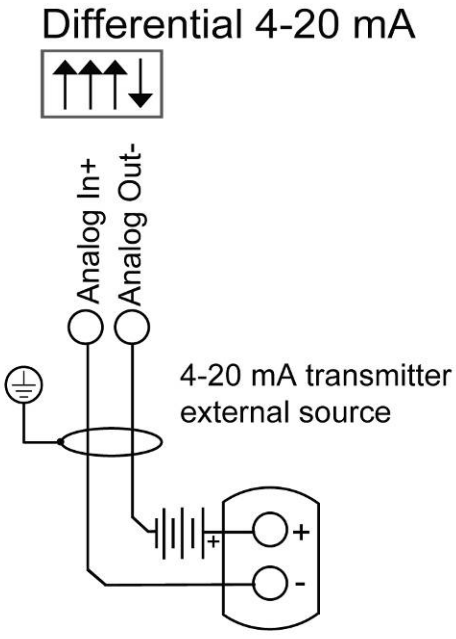


Analog 4-20 mA Transmitter

(Intrinsically Safe when installed as per **APPENDIX A: Drawings**)

The use of conventional 4-20 mA transmitters requires factory-installed precision load resistors on each analog channel. Power for the current loop is normally obtained from the Scanner's internal power supply, but may also be drawn from an external source.

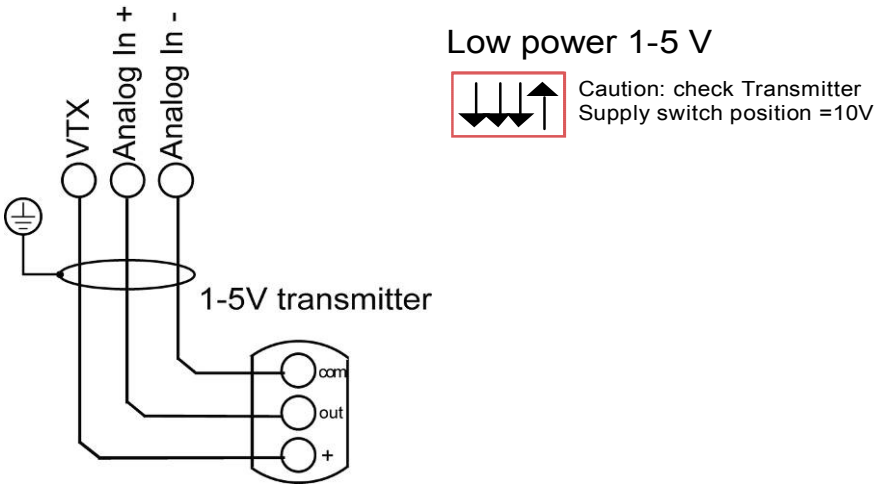




Analog 1-5 Vdc Transmitter

(Intrinsically Safe when installed as per **APPENDIX A: Drawings**)

Conventional 1-5 Vdc transmitters do not require load resistors. Power for the circuit is normally obtained from the Scanner's internal power supply, but may also be drawn from an external source. This configuration is intrinsically safe -- Maximum current requirements per I.S.

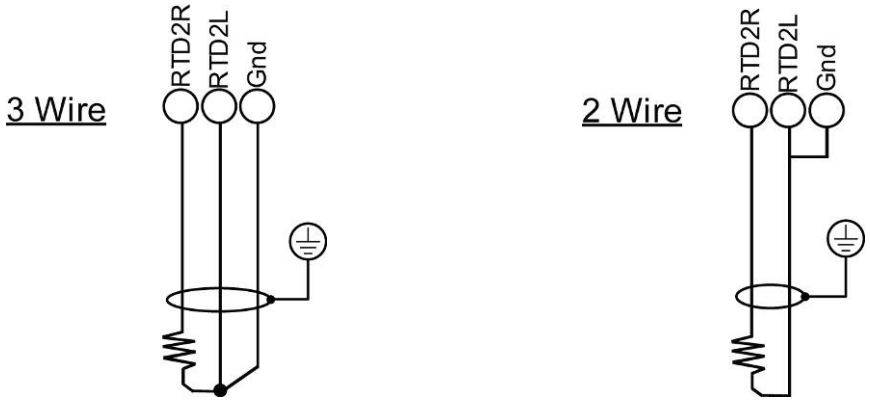


Note: The **TOTAL** +10V transmitter output (e.g. Vtx10, Vtx1-3 **and** Vtx4-6) is 15mA.

RTD Inputs (Resource A27, A28)

(Intrinsically Safe when installed as per **APPENDIX A: Drawings**)

Resource A27 and A28 are connected to 100 Ω 3-wire platinum RTD's as shown. The RTD characteristic curve is software-selectable for temperature coefficients of either 0.00385 or 0.003902 (Ω/Ω/°) or by performing a loop calibration at three or more points (refer to Analog and RTD Calibration in Section 2 of IGas, NGas and NFlo manuals). Platinum 2-wire RTD's can be used by jumping the lead-line compensation terminals together as shown:



Note: Shielded wire must be used.

Pulse Inputs (Resources A05, A06)

The Scanner 1131 optional pulse inputs are designed to interface with a wide variety of devices including variable-reluctance magnetic pickup coils, signals from turbine preamplifiers (both voltage and current output types), and simple contact closures. DIP switches select the type of signal for each pulse input.

Resources A05 and A06 are pulse inputs. Both switches (**SW9** and **SW10**) are located in the lower middle of the circuit board (see the diagram on **page 34**).

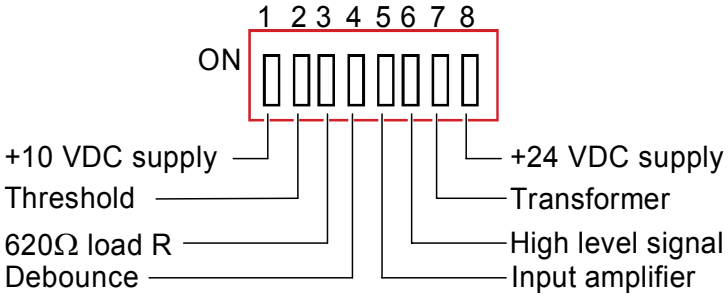
With firmware NFlo M4.2.0x and higher, pulse input #1 ***(A05)***, was modified to count individual pulses and increment the count by 1. Previous firmware versions always counted by two; thus, two individual pulses were required before the pulse count was incremented by 2.

Note: If the SW9 or SW10 switches are not present, the pulse input option is not installed.

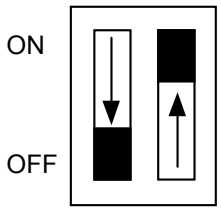
Please refer to chapter **8: System Specifications** for the acceptable input signal levels for all the following types of input devices.

The following chart summarizes the settings and specifications for the 1131 pulse input DIP switches.

Switch #	*ON*	*OFF*
1	Provides V_{DD}, *V to the (+) terminal (for 10 V power to proximity switches)	N/A
2	6.0 V Threshold (nominal)	1.25 V Threshold (nominal)
3	Switches are set at 620Ω in a load resistance for current type preamplifiers	Regular for voltage type preamplifiers or dry contacts
4	Switches in a filter capacitor for contact debouncing	Regular (no contact debouncing)
5	First stage preamplifier to comparator	N/A
6	Input signal to comparator (high level inputs)	N/A
7	+Terminal to transformer for low level signal (e.g. from turbine p/u)	Transformer not connected
8	Vtx supply to +terminal for high level devices such as preamplifiers	Vtx not connected to +terminal



The following diagram illustrates the **ON** and **OFF** positions as they are used in the pulse input diagrams:



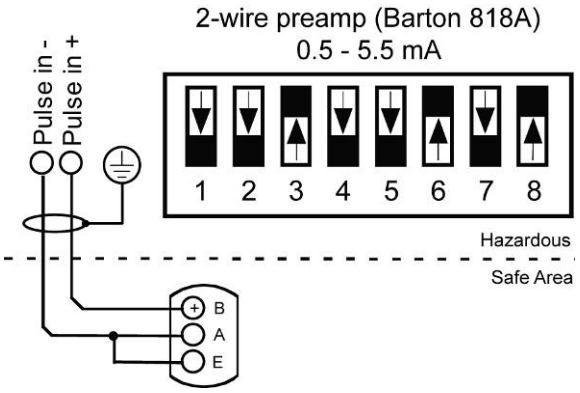
Note: The **TOTAL** +10 V transmitter output (e.g. Vtx10, Vtx1-3 **and** Vtx4-6) is 15 mA. See **page 36**.

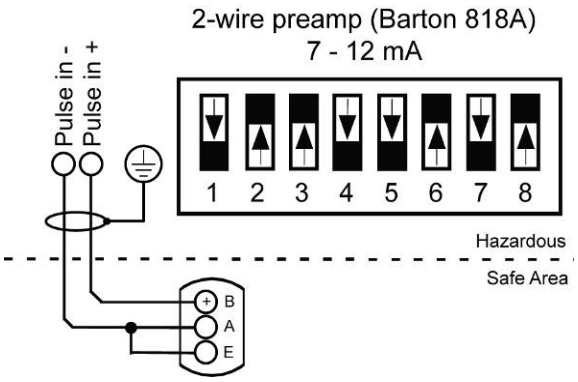
2-Wire Preamplifier (818A Current Loop Mode)

(Intrinsically Safe when installed as per **APPENDIX A: Drawings**)

DANGER: These configurations are **NOT** intrinsically safe for the Scanner 1131 unless barriers are installed.

This mode is suitable for use with the Barton Model 818A preamplifier configured for current-loop output mode. This preamplifier provides a transmission up to 5 km.



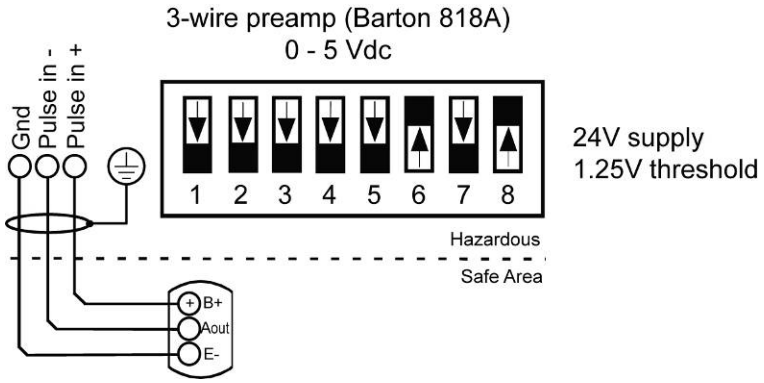


3-Wire Preamplifier Frequency Input

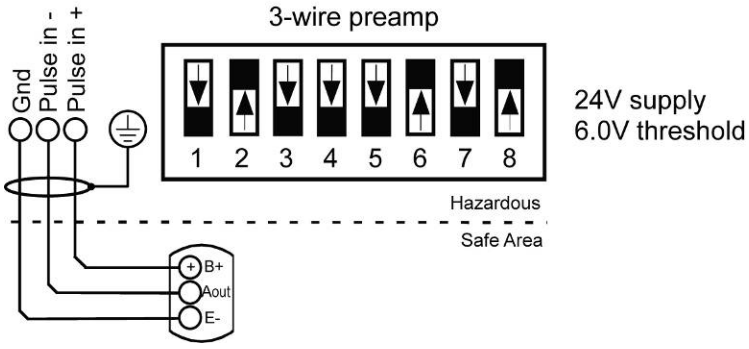
(Intrinsically Safe when installed as per **APPENDIX A: Drawings**)

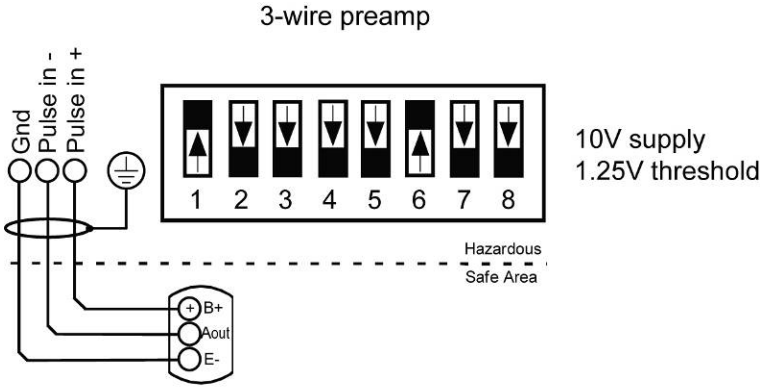
DANGER:	These configurations are **NOT** intrinsically safe for the Scanner 1131 unless barriers are installed.

This mode is suitable for use with the Barton 818A preamplifier configured for voltage output with a 0-5 Vdc.



The following illustrates settings for non-Barton preamplifiers:

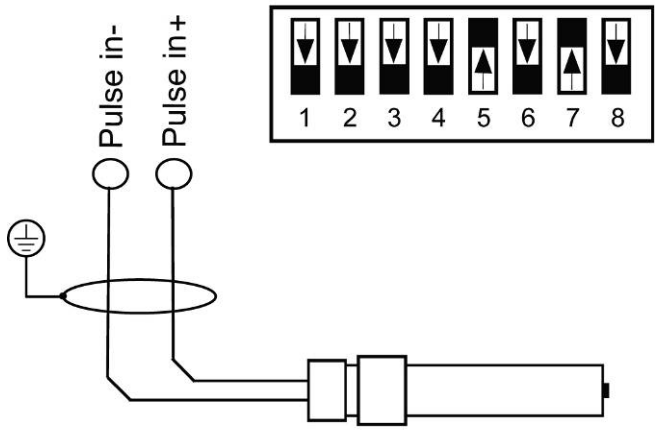




Magnetic Pickup Coil

(Intrinsically Safe when installed as per **APPENDIX A: Drawings**)

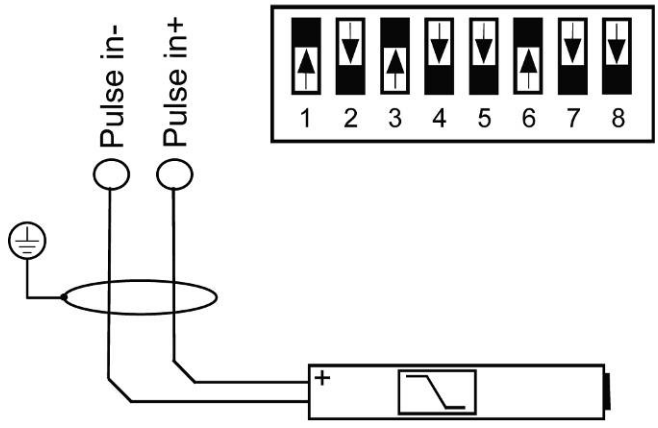
In this mode, the pulse input is directly connected to a standard variable-reluctance pickup coil that is used on the Barton turbine meters and other meters of similar design. The input is transformer-coupled to ensure common-mode noise rejection, and incorporates a variable gain stage to increase the sensitivity to low frequency and low amplitude signals. Shielded cable, such as Belden 9322, is required.



Proximity Switch

(Intrinsically Safe when installed as per **APPENDIX A: Drawings**)

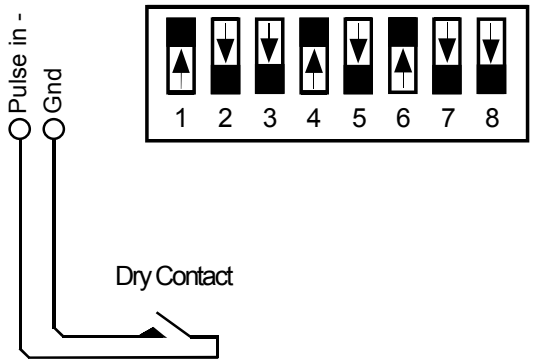
In this mode, the pulse is compatible with the BSR (Rockwell) slot sensor or other pulsers that provide a current output that is signal compatible with the Pepperl & Fuchs #SJ2-N inductive proximity sensor.



Contact Closure

(Intrinsically Safe when installed as per **APPENDIX A: Drawings**)

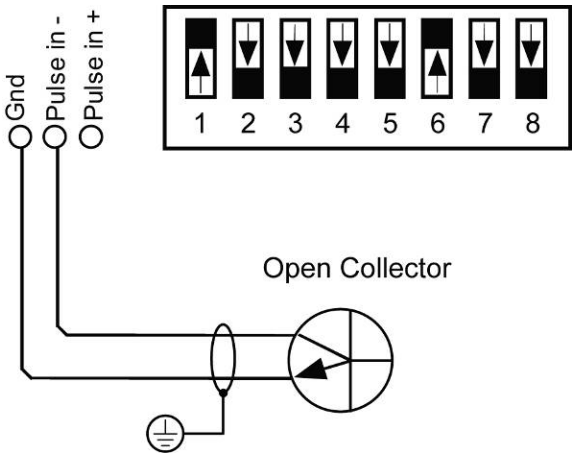
In this mode, the pulse input is connected to any device that provides a passive contact closure, such as a reed relay or micro switch. Excitation voltage is provided by the Scanner 1131. Debouncing circuitry limits the input frequency to 10 Hz maximum.



Open Collector

(Intrinsically Safe when installed as per **APPENDIX A: Drawings**)

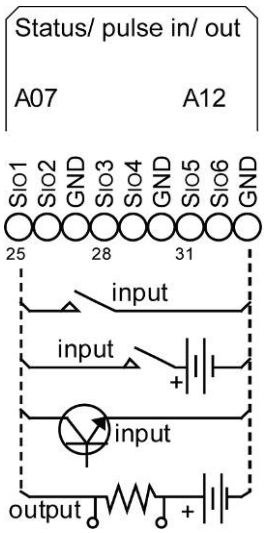
This mode provides a generic pulse input, which is compatible with a variety of pulsers and other end devices. A suitable end device is one that provides a bounce-free solid state output stage, such as an open collector transistor, or an open-drain MOSFET.



Status Inputs and Status/Pulse Outputs (Resources A7 to A12)

(Intrinsically Safe when installed as per **APPENDIX A: Drawings**)

The Status Inputs and Status/Pulse Outputs are software configurable.

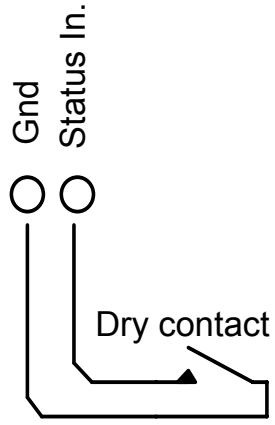


Status Inputs

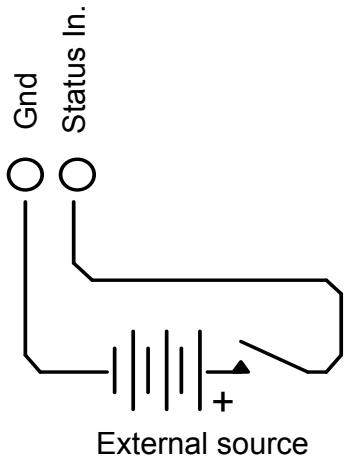
(Intrinsically Safe when installed as per **APPENDIX A: Drawings**)

Status inputs are used to read the state of an external device, which can be either passive (e.g. contact closure) or active where excitation is from an external source.

The type of input is selected by software. When a passive input is selected, an internal power source attempts to drive a 50 microampere current through the circuit. The voltage through this circuit is limited to 3.2 Vdc. When an active input is selected, the user is provided software selectable voltage thresholds of 2, 7 or 10 Volts. Below the threshold, the input will be false (off); above the threshold, true (on).



Passive

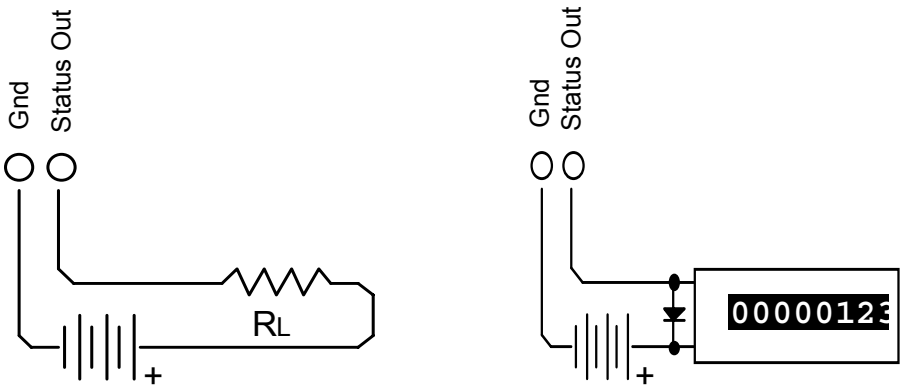


Active

Status/Pulse Outputs

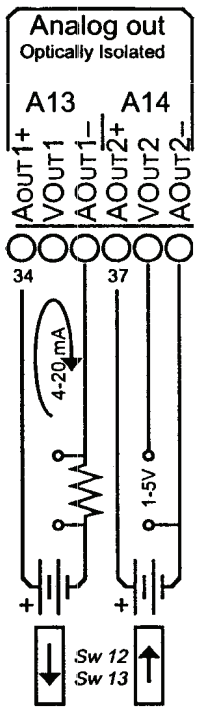
(Intrinsically Safe when installed as per **APPENDIX A: Drawings**)

This output is used for either status (e.g. alarms) or pulse trains (e.g. accumulated volume) as selected by software. The circuit is suitable for a variety of end devices including small inductive loads such as electromechanical counters. The output circuit has limited protection against inductive "kickback" from such devices, but by strapping a diode across the load, as illustrated below, an additional safety factor is gained. Current requirements in excess of 100 mA require the use of interposing relays. The transmitter power supply (terminals marked "Vtx"; refer to **Main Board Wiring Diagrams**) should not be used for excitation since the computer can switch off the power to these terminals under software control. Excitation should instead be drawn from an external source, as shown:



Analog Output (Resources A13, A14)

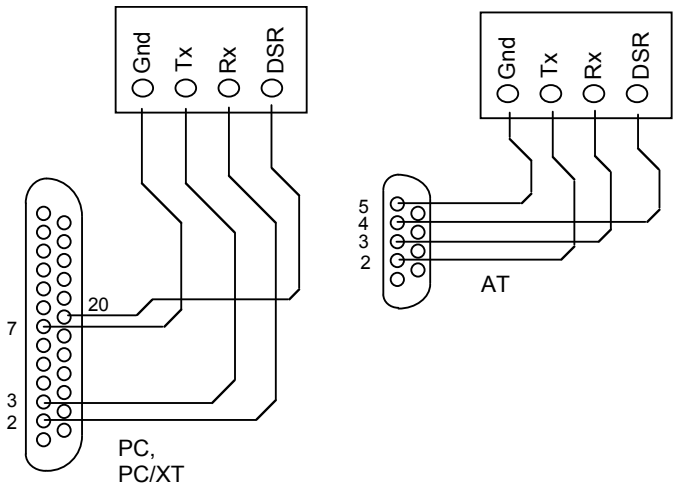
(Intrinsically Safe when installed as per **APPENDIX A: Drawings**)



Console Serial Port (Resource A01)

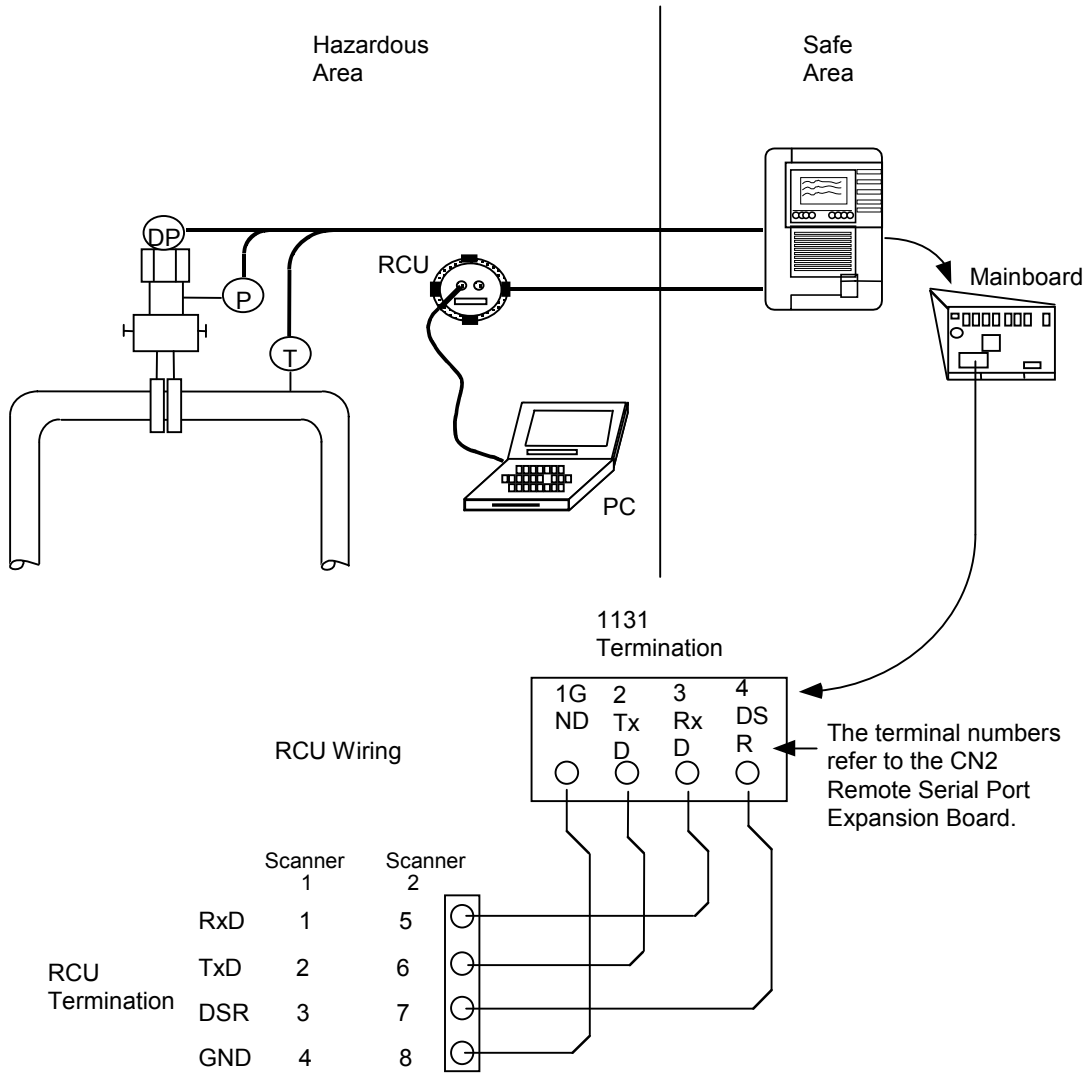
(Non-Intrinsically Safe)

The console port is accessed through the socket on the front panel of the instrument. Shared access to the serial port A01 is available on optional terminal strips CN2 (Remote Console Accessory Board) or CN3 (a Remote Console Communication Board). This port is used with a console device only. Shared access can be set up with either a Remote Console Accessory Board or a Remote Console Communication Board which are typically used with a Remote Calibration Unit (RCU).



If the Scanner Measurement RTU is installed in a safe area, an RCU can be located in a hazardous area, close to transmitters. The RCU enables communication with the Scanner so that loop calibration routine can be performed. The RCU can have either one or two local console connectors.

The following diagram illustrates an RCU with two connections.



Note: The user may also use the CN3 Communications Accessory Board or the second serial port of the main board if the port is assigned to a remote console.

Auxiliary Serial Port (Resources A02, A03 and A04)

(Intrinsically Safe when installed as per **APPENDIX A: Drawings**)

The auxiliary serial ports A02, A03 and A04 support full RS232C hardware (handshaking signals standard). Ports A02 and A04 also optionally support RS-422 and RS-485 communications (user selectable).

Port 2 (A02)	Located on main board (terminal strip connections 1-7)	
	Type:	RS-232C, (optional RS-422, or RS-485)
	Signals:	Rx, Tx, RLSD (DCD), RTS, CTS, DTR, and Gnd

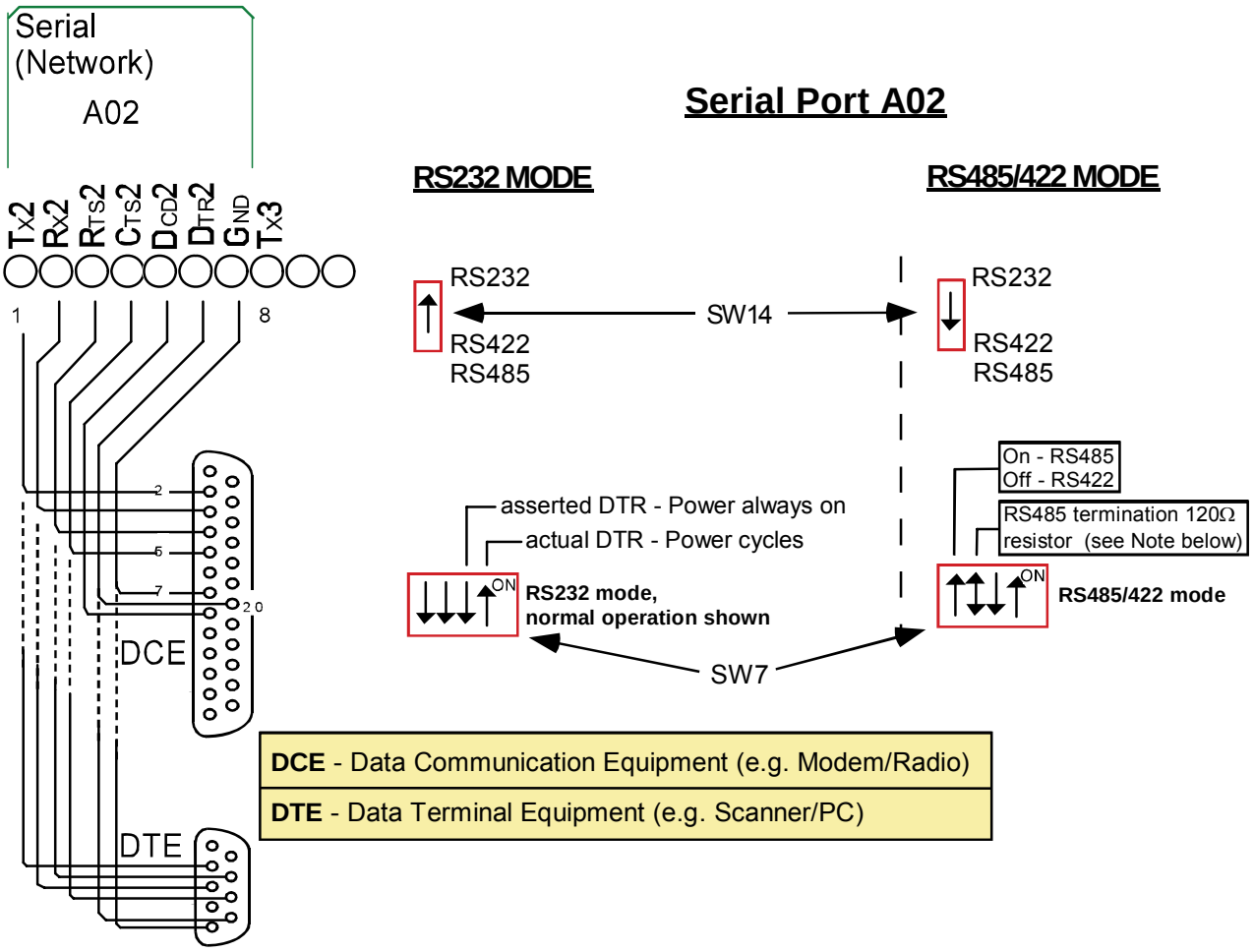
***Note*:** "RLSD" is more commonly known as "DCD."

Port 3 (A03)	Located on main board (terminal strip connections 8-13)	
	Type:	RS-232C
	Signals:	RX, TX, RTS, CTS, RLSD and Gnd
Port 4 (A04)	Located on main board (terminal strip connections 14-19)	
	Type:	RS-232C (optional RS-422, or RS-485)
	Signals:	RX, TX, RTS, CTS, RLSD and Gnd

These ports are used with a modem to provide remote communications (refer to NGas/NFlo 2.X/3.X, Network Settings). The auxiliary serial ports can also be configured as a second console port (refer to NGas/NFlo 2.X/3.X, - System Settings).

The switches to select RS232C or RS485/422 for serial ports A02 and A04 are located in the bottom left corner of the main board. See diagram on **page 34**.

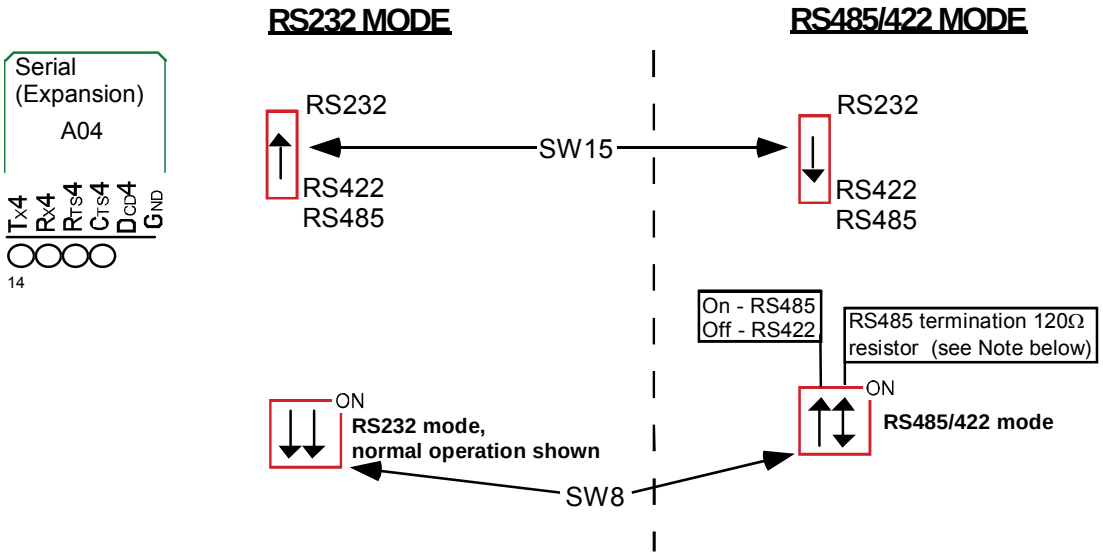
The switch positions for serial ports A02 and A04 are shown in the diagrams below.



Note: * If the Scanner is LAST in the 485 loop, the 120Ω termnation switch should be left in the "***ON***" position; place switch in the "***OFF***" position if it is not.

Terminal	*RS232C*	*DCE*		*RS-422*	*RS-485*
		DB25	*DB9*		
1	Tx	2	3	Rx+	Sig +
2	Rx	3	2	Rx-	Sig-
3	RTS	4	7	Tx+	N.C.
4	CTS	5	8	Tx-	N.C.
5	DCD	8	1	N.C.	N.C
6	DTR	20	4	N.C.	N.C.
7	Signal Ground	7	5	Signal Ground	Signal Ground

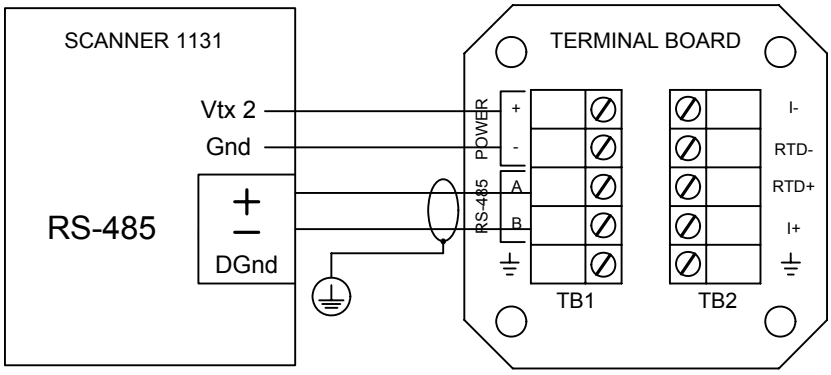
Serial Port A04



Note: * If the Scanner is LAST in the 485 loop, the 120Ω termnation switch should be left in the "***ON***" position; place switch in the "***OFF***" position if it is not.

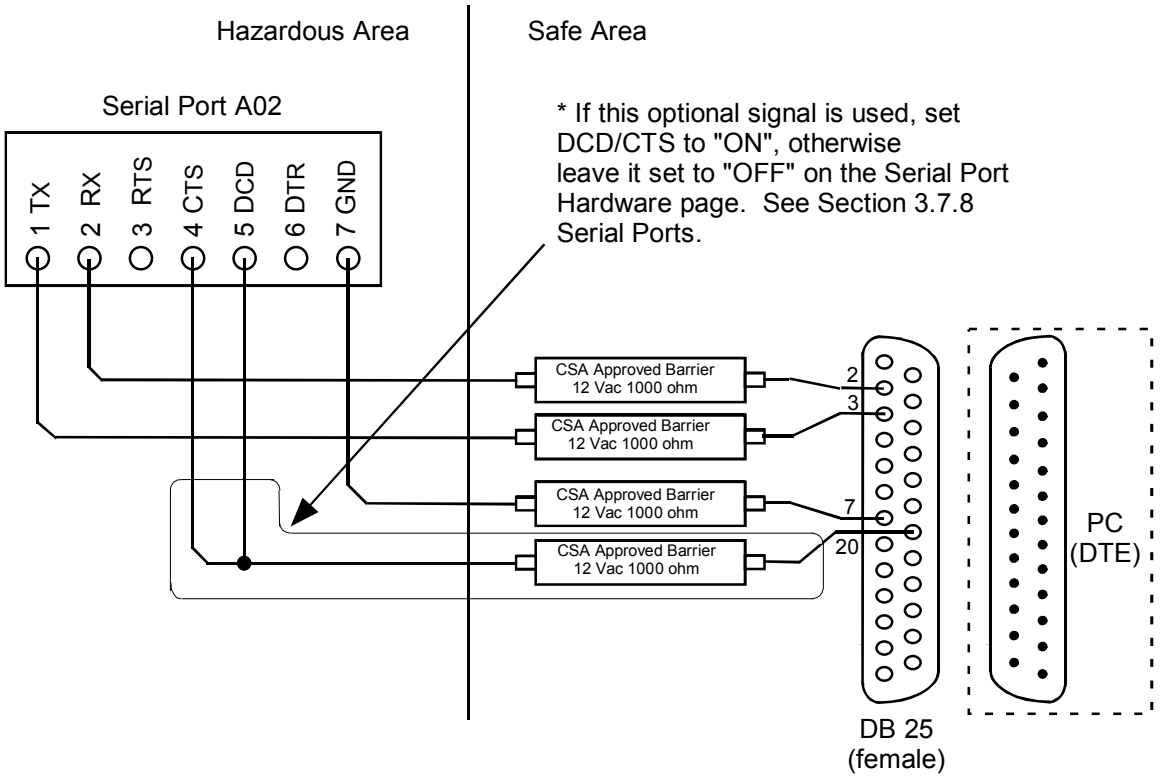
Terminal	*RS232C*	*RS-422*	*RS-485*
14	Tx	Rx+	Sig +
15	Rx	Rx-	Sig-
16	RTS	Tx+	N.C.
17	CTS	Tx-	N.C.
18	DCD	N.C.	N.C
19	Signal Ground	Signal Ground	Signal Ground

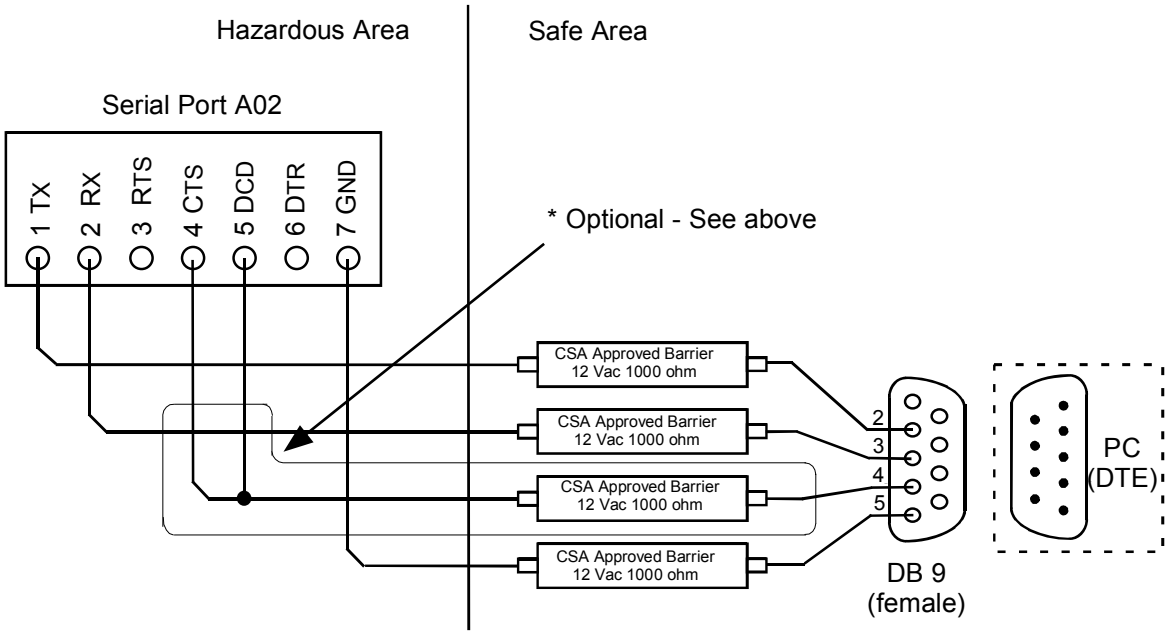
MVX-II Wiring for Serial Port A02 or A04



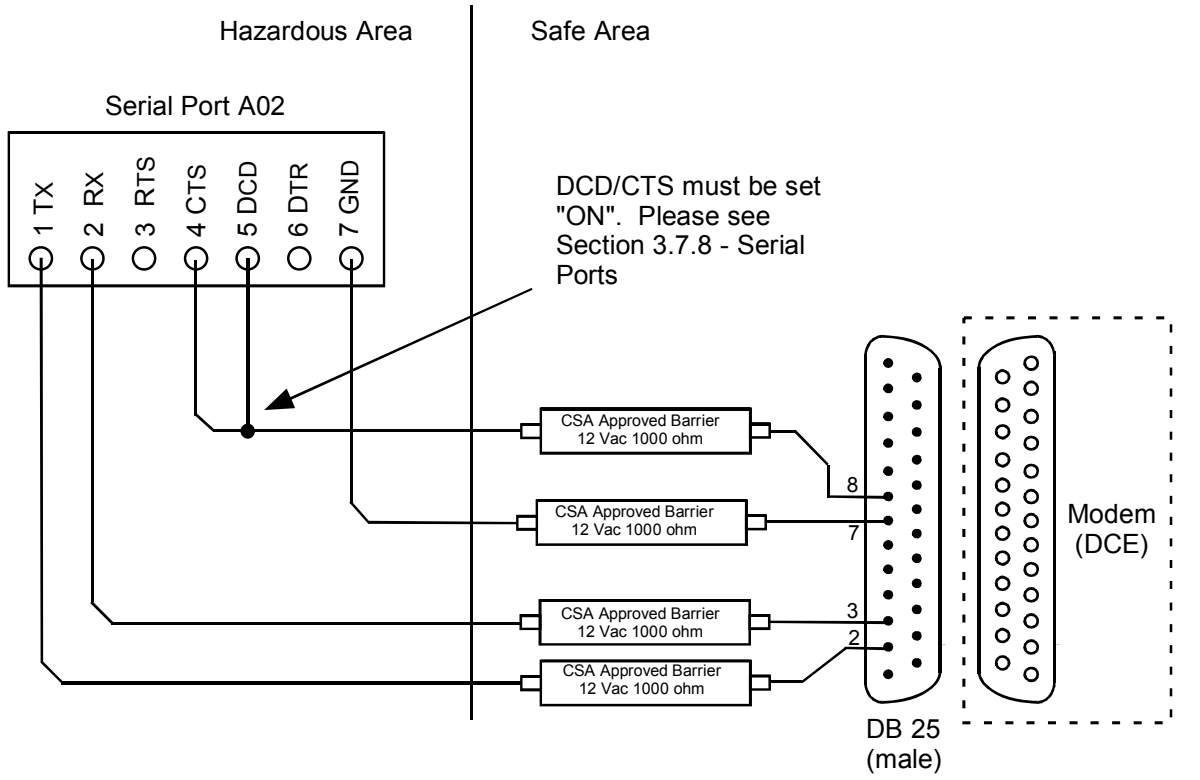
Up to two MVX-II instruments can be powered from the Vtx2 (12 Vdc) terminals of the Scanner 1131. RS-485 +/- terminals for A02 are #1 and #2. RS-485 +/- terminals for A04 are #14 and #15.

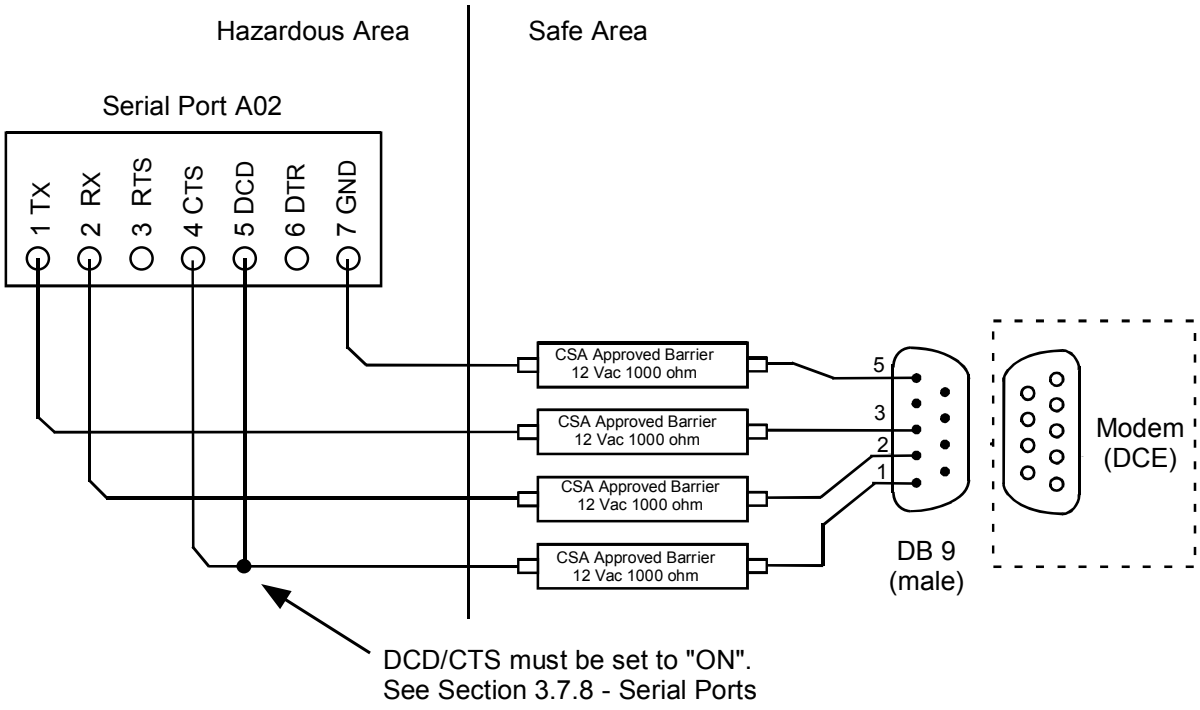
ScanPC Direct Connection



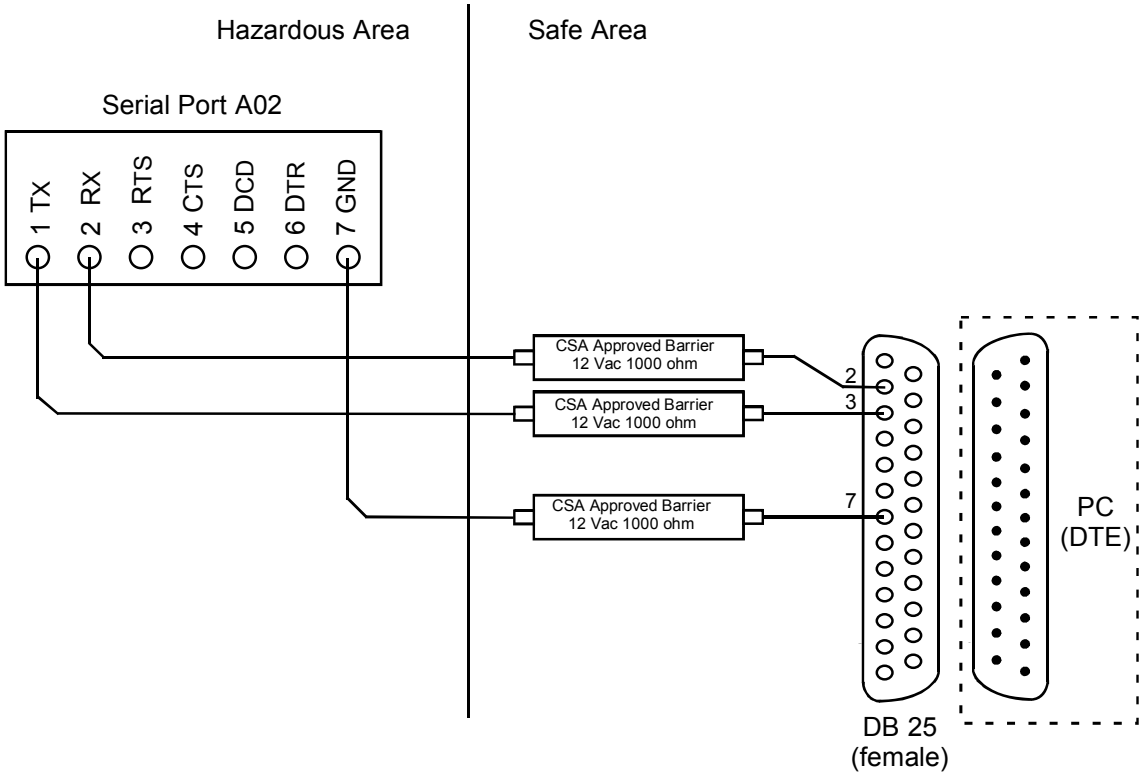


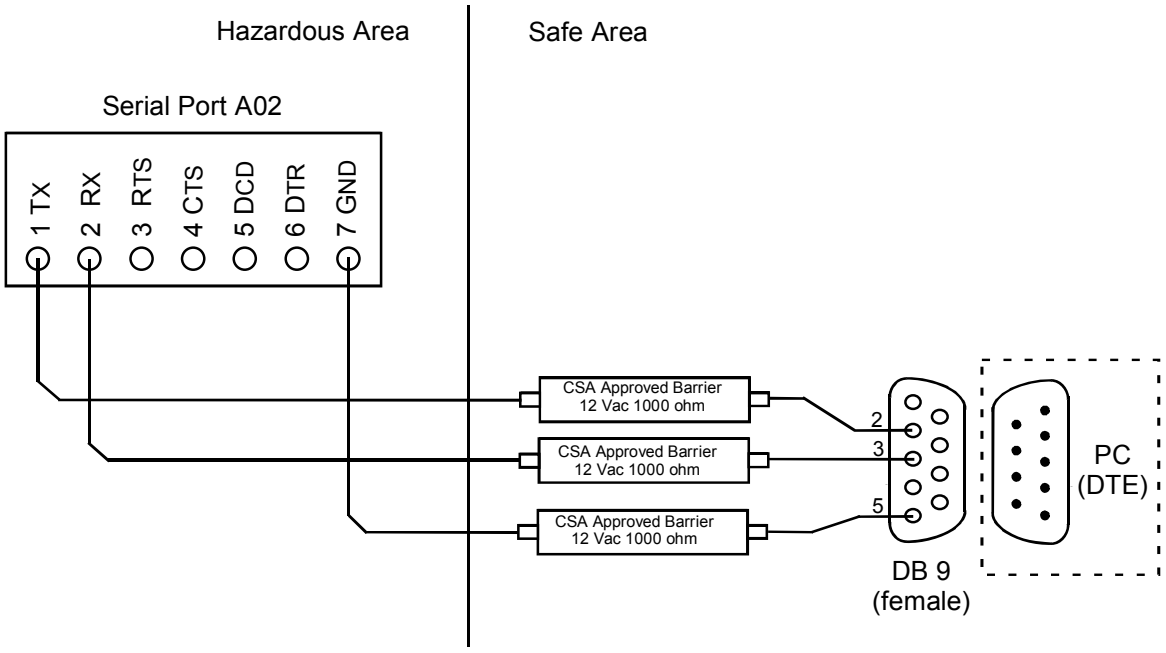
ScanPC Modem Connection



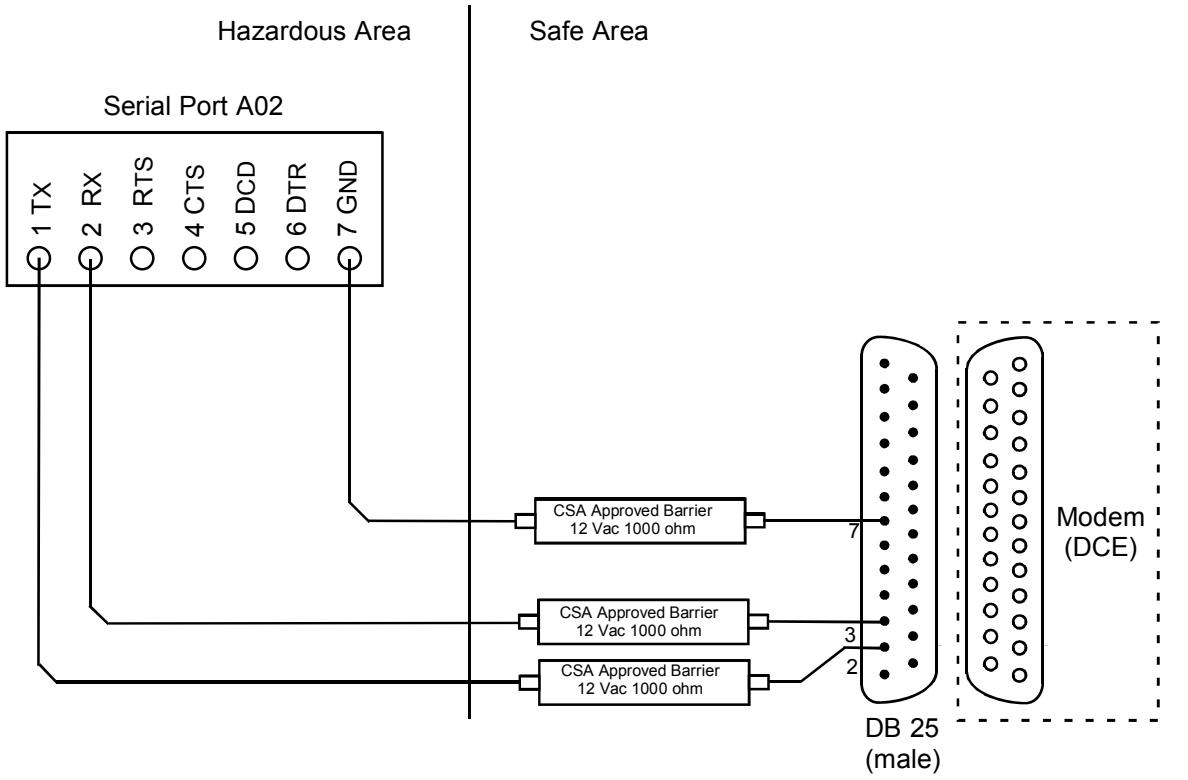


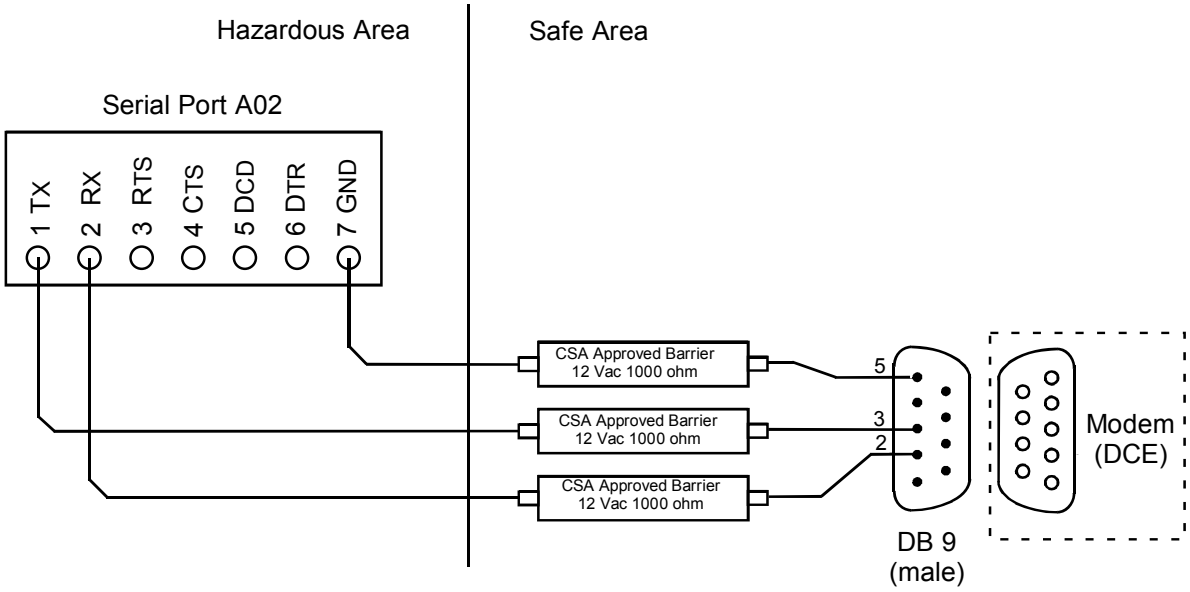
ScanPol / ScanOp Direct Connection





ScanPol / ScanOp Modem Connection





3: Expansion Boards

Expansion Boards

Up to two expansion boards can be added to the Scanner's main circuit board. The expansion boards are plugged into the slots (B and C) shown in the following diagram:

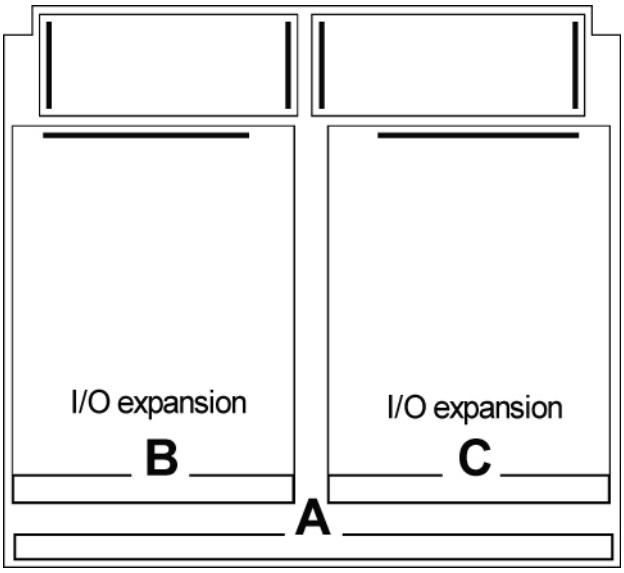
AS01 – Up to 3 Analog and 3 status outputs

CA01 – Communications and up to 4 analog outputs

CD01- Communications and up to 4 digital inputs/outputs

DI01 – Up to 5 Digital inputs / outputs or Frequency inputs

EB02 – Ethernet and Bluetooth mounted in slot B



Analog and Status Output (AS01)

Specification

General

CSA certified for intrinsically safe operation in Class 1, Division 1, Group C & D areas (when used with approved barriers - pluggable terminal blocks). The ASO1 Expansion Board is only used on the right-hand side with expansion Slot C, on main boards with Revision Level 6 and less. This board also offers automatic test support.

Analog Outputs

Number of Channels	3 (maximum)
Type	Optically isolated, externally powered
Signal Type	4-20 mA current loop, externally powered
Supply Voltage	Minimum <+10 Vdc (liftoff voltage)
	Maximum +40 Vdc, across terminals
Accuracy	± 0.1% F.S. error at 25°C (75°F)
D/A Resolution	2 bits
Temperature Effect	± 1% F.S. maximum error over operating temperature range
Calibration	Zero and Full-scale software calibration
Setting Time	<1 second width ±0.1% of F.S. for a 10% step change
Surge Protection	Optically isolated, polarity protected, and surge protected to 500 W for 1 msec.
Allocation	User-selectable

Status/Pulse Outputs

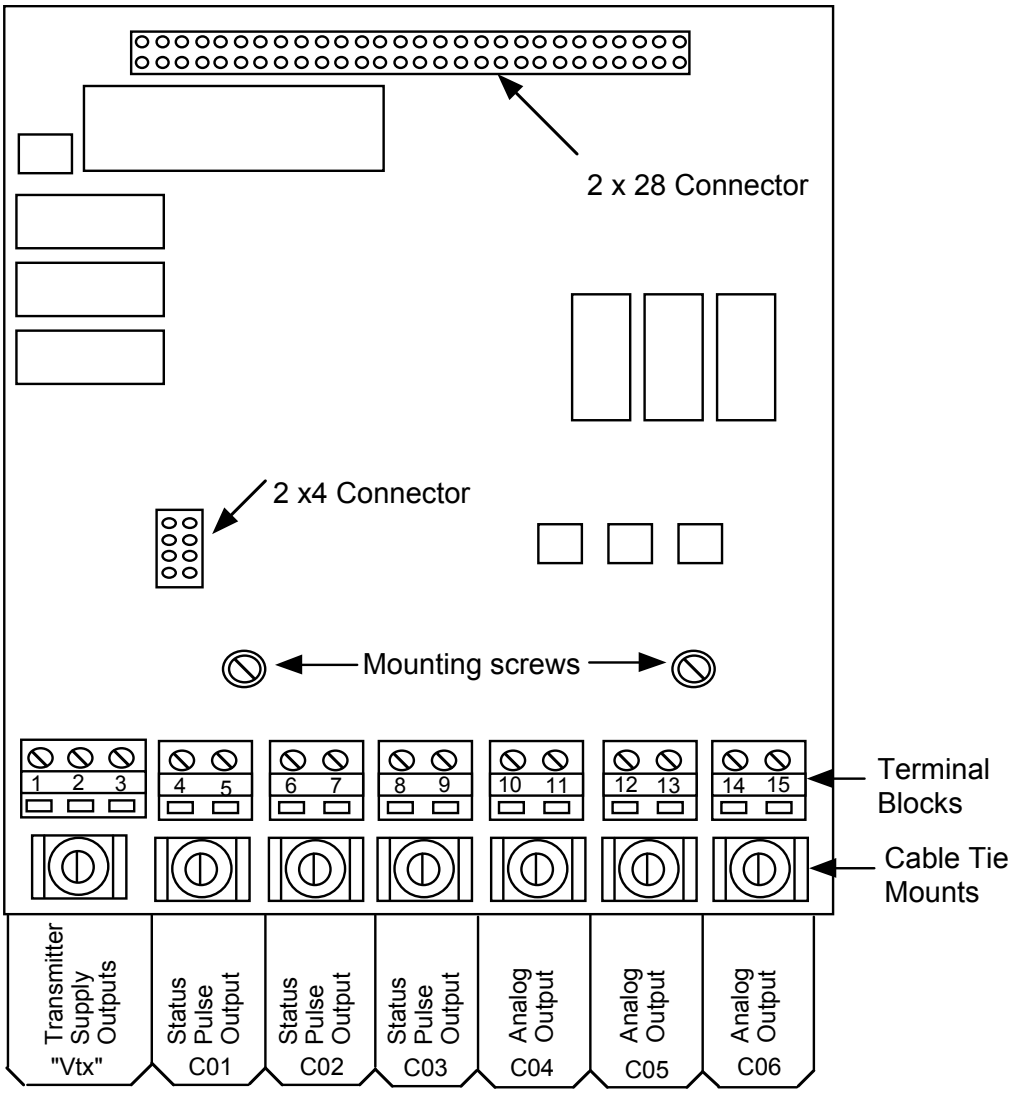
Number of Outputs	3 (maximum)
Type	Optically isolated
Count Rate (Pulse Mode)	0 to 8 Hz, 50 % duty cycle maximum
Max On-State Current	100 mA (fused at TBD mA)
Max On-State Resistance	30 Ω typical at 25°C (75°F)
	50 Ω maximum at 25°C (75°F)
Max Off-State Voltage	40 Vdc
Max Off-State Leakage	100 µA over temperature
Surge Protection	Optically isolated, polarity protected, and surge protected to 500 W for 1 msec.
Typical Usage	Status Mode: Alarms
Pulse Mode:	Accumulating Count Output (volume, mass, energy, etc.)
Allocation	User-selectable

The available combinations of outputs on the ASO1 expansion board are as follows:

Analog Outputs	*Status / Pulse Outputs*
3	3
1 (Resource 04)	1 (Resource 01)
0	3
3	0

Wiring Diagrams

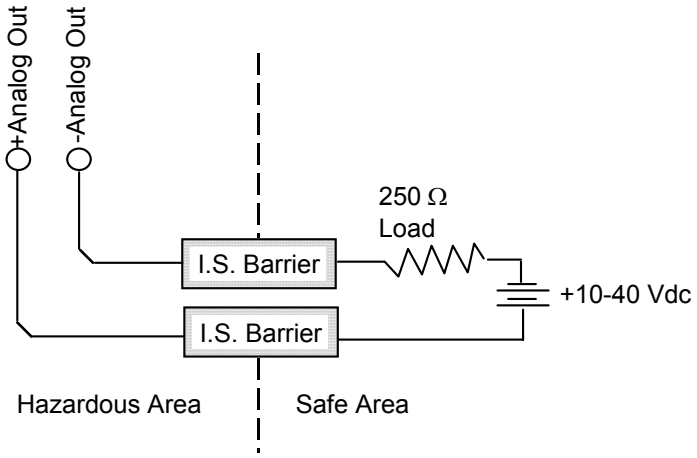
The following figure shows the terminal numbers and the corresponding resource allocations for the ASO1 outputs. The example below assumes the expansion board is connected to Slot C.



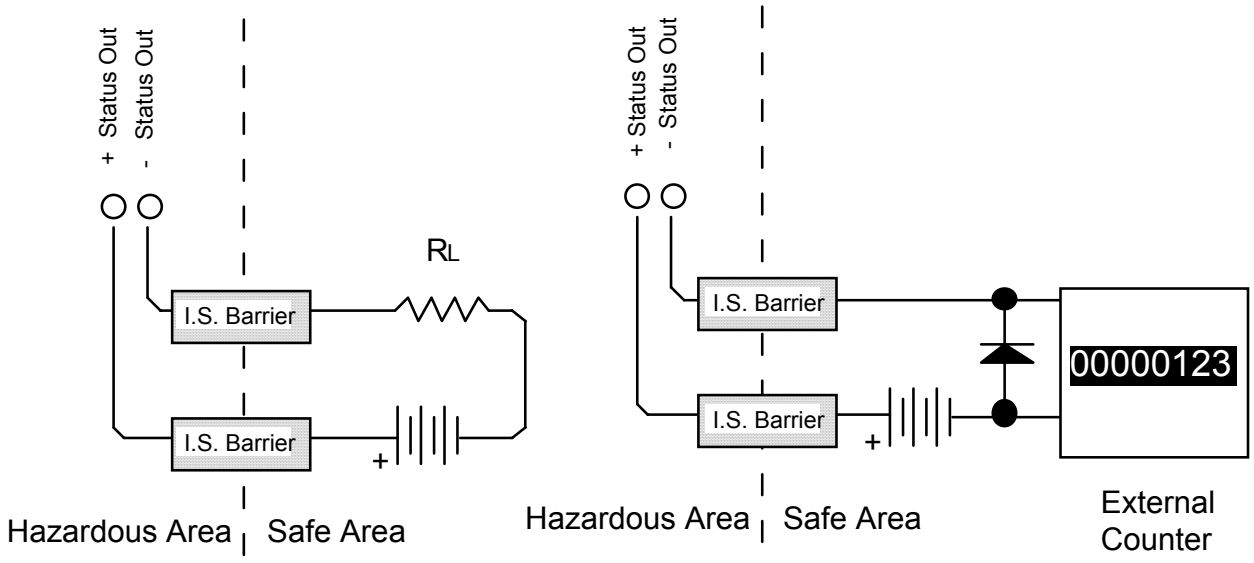
Isolated Wiring Diagrams

For installations where the flow computer is located in a safe area, the Intrinsically Safe barriers are not required.

Analog Outputs:



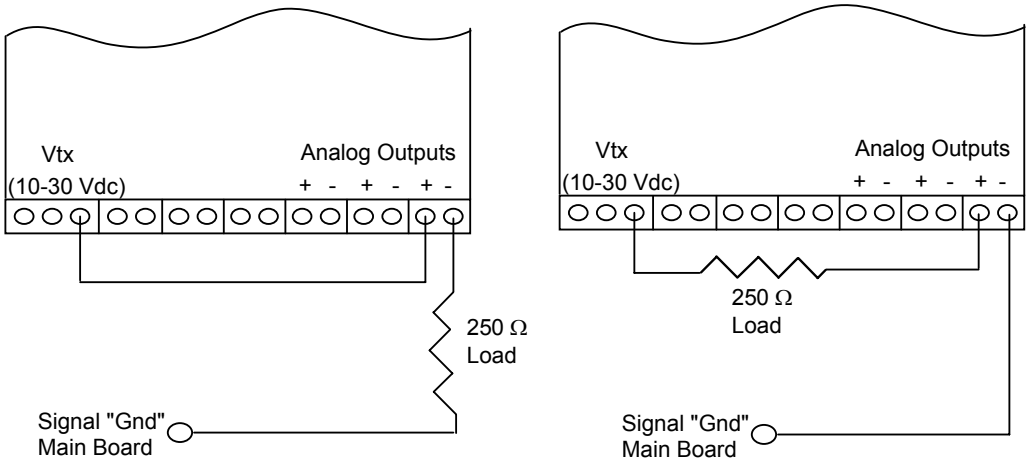
Status/ Pulse Outputs:



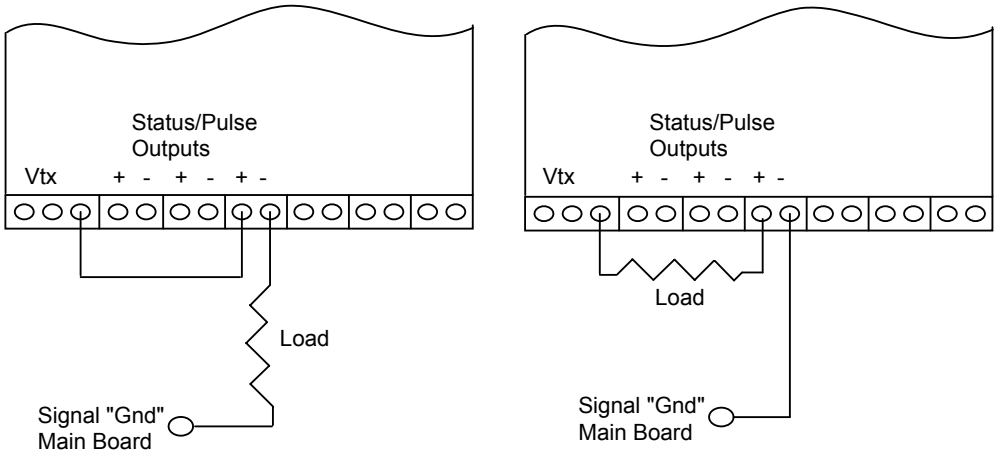
Non-Isolated Wiring Diagrams

The DC power supply (24 Vdc nominal) should be used when powering outputs from the "Vtx" terminals. The Intrinsically Safe battery power supply is not designed to power analog outputs.

Analog Outputs:



Status / Pulse Outputs:



Communications and Analog Output (CAO1)

The Communications / Analog Output expansion board available for the Scanner 1131 Flow Computer offers several different configurations of asynchronous serial communications and 0 to 4 isolated analog channels.

Note: This serial communications port is *not* recommended for ScanCom networks.

This board is no longer manufactured

Specifications

General

Operating Temperature	-40°C to +60°C (-40°F to 140°F)
Storage Temperature	-55°C to +85°C (-67°F to 185°F)
Relative Humidity	0 to 95 % RH non-condensing
Certification	Individual circuits CSA approved for Intrinsically Safe operation in Class 1, Division 1, Group C & D areas when used with appropriate barriers.

Serial Communications

Quantity	One
Interface	Switch selectable as RS-232C, RS-422, or RS-485
Available Signals	RS-232C: Rx, Tx, RTS, CTS, DCD, and DTR
	RS-485: Signal+, Signal-
	RS-422: Tx+, Tx-, Rx+, Rx-
Baud Rates	110, 150, 300, 600, 1200, 2400, 4800, or 9600 baud, software selectable
Parity	Even, odd, or none, software selectable
Stop Bits	1 or 2, software selectable
Function	Printer, remote console, or gas chromatograph port
Protection	Surges to 300 W @ 1 msec. plus DC overload to ±40 V

Analog Outputs

Quantity	Four
Type	Optically isolated, externally powered
Accuracy	± 0.1 % of FS max. error @ 25°C (75°F) (after factory calibration)
Temperature Effect	± 1.0 % of FS maximum error over temperature
Liftoff Voltage	< + 10.0 Vdc
Maximum Voltage	± 40 Vdc
D/A Resolution	12 Bits
Calibration	Zero and Full-scale software calibration
Setting Time	< 10 msec. to 0.1 % of full-scale for a 10 % step change
Function	User assignable (Flow rate, temperature, etc.)

Field Wiring Termination

Terminal	*RS232C*	*RS-422*	*RS-485*
1	Signal Ground	Signal Ground	Signal Ground
2	Tx	Rx+	Sig +
3	Rx	Rx-	Sig-
4	RTS	Tx+	N.C.
5	CTS	N.C.	N.C.
6	DTR	Tx-	N.C.
7	DCD	N.C.	N.C
8	Signal Ground	Signal Ground	Signal Ground
9	Transmitter Supply	Transmitter Supply	Transmitter Supply

Options

- Industry Canada Switch Stuffing (Configuration Lock) - Once locked, the port assignment for this board cannot be changed accidentally
- Uninterrupted Vtx (to a low power relay)
- The remote console expansion board that plugs into the lower pins of expansion slot B can also be plugged into the CAO1 expansion board.

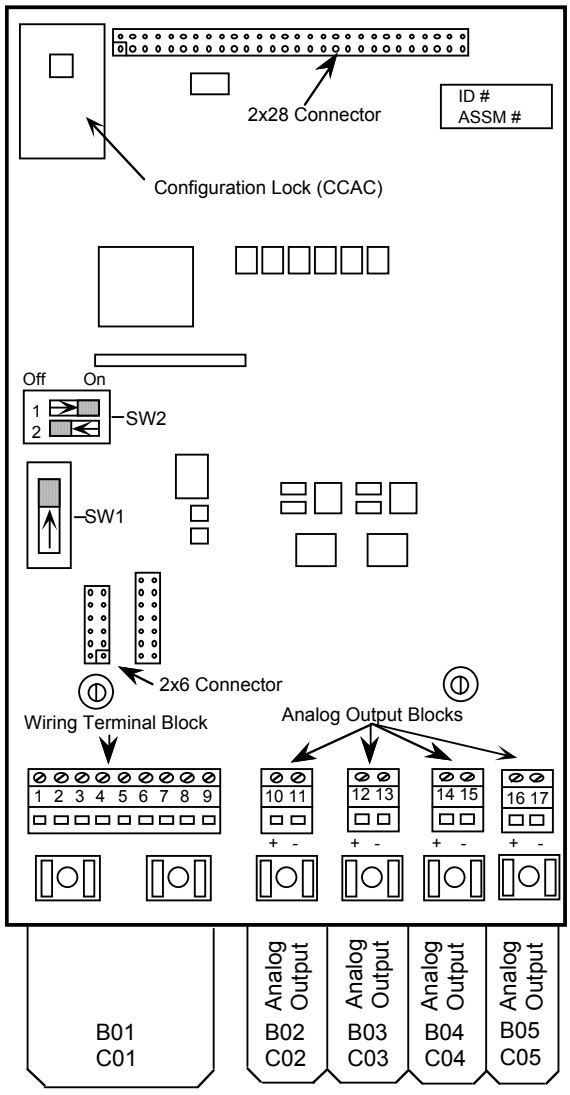
Installation

The expansion board mounts over the 1131 main board either on the left side resource ‘B’ connectors, or on the right side resource ‘C’ connectors.

Place the CAO1 card so that the terminal strips are facing down toward you. Align the pins and sockets located on the expansion board and the main board; then push down firmly. Ensure that the sockets fully cover all the pins and are not offset by one pin location. Two captive screws fasten to the board securely to two standoffs on the main board.

Wiring Diagrams

The following figure shows the terminal numbers and the corresponding resource allocations for the CAO1 outputs:

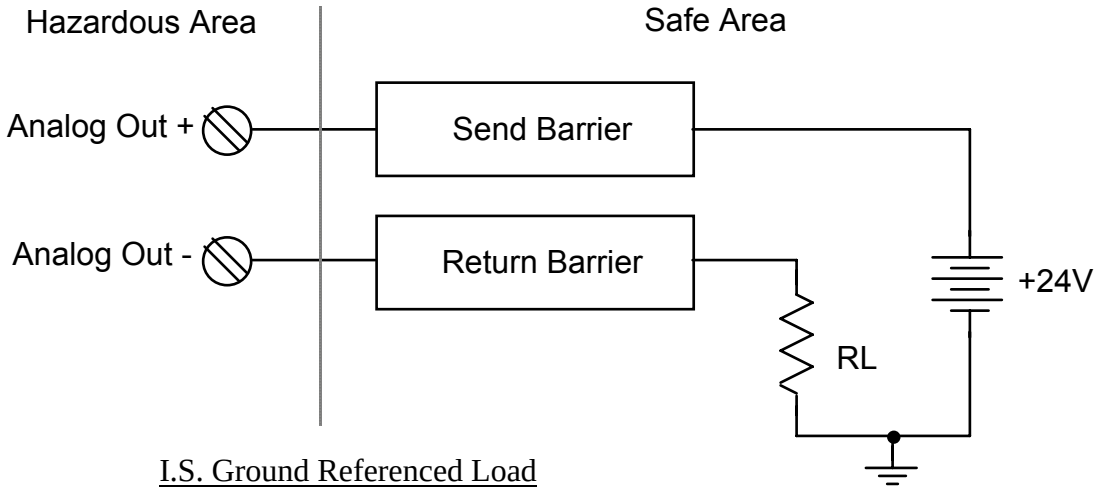


CAO1 Setup

Analog Outputs

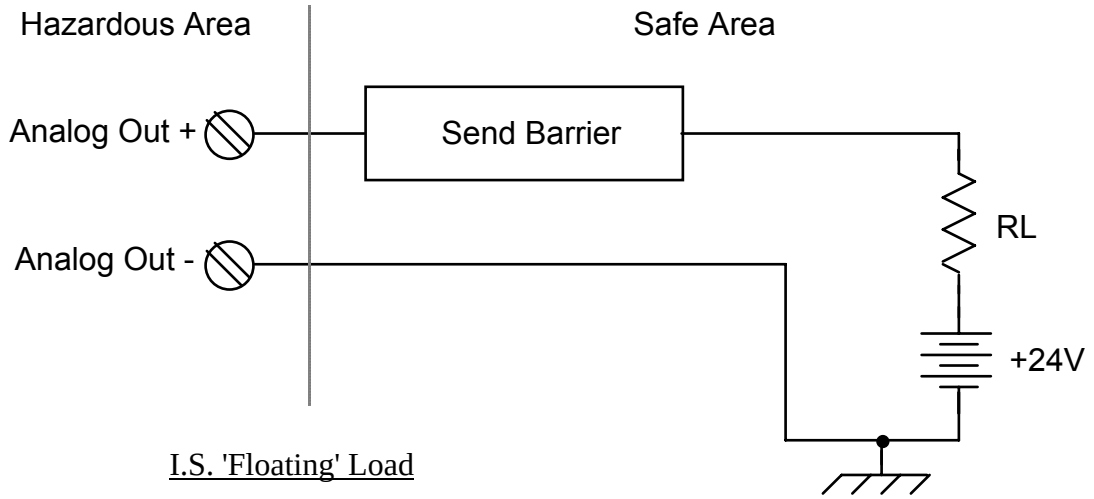
The analog output ports are designed to manipulate an external power source of proper magnitude to achieve a 4 to 20 mA current. The correct wiring method for analog output ports on a CAO1 board is illustrated bellow:

Intrinsically Safe Ground Referenced Load:



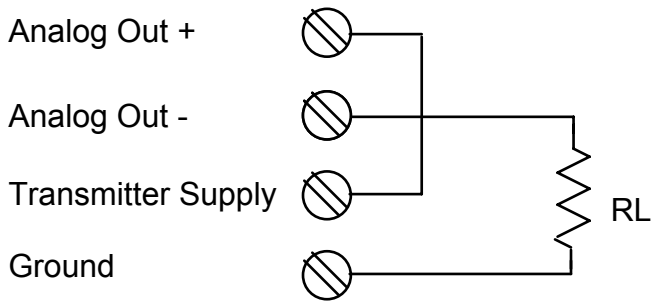
I.S. Ground Referenced Load

Intrinsically Safe "Floating" Load:



I.S. 'Floating' Load

Non-Intrinsically Safe Ground Referenced Load:

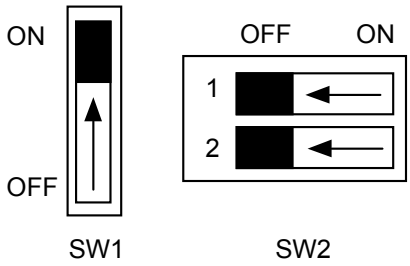


Non-I.S. Ground Referenced Load

Communications

The serial port can be configured to an RS-232C, RS-422, or RS-485 electrical configuration. This is done by setting the DIP switches.

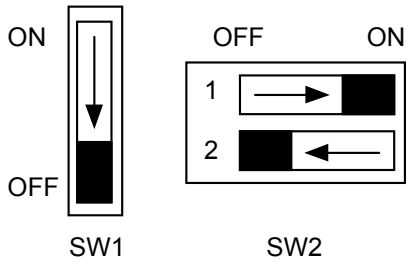
RS-232C: The DIP switch settings for RS-232C are as follows:



The terminal block wiring assignments are:

Terminal	*Signal*
1	Ground
2	Transmit Data (Tx)
3	Receive Data (Rx)
4	Ready to Send (RTS)
5	Clear to Send (CTS)
6	Data Terminal Ready (DTR)
7	Data Carrier Detect (DCD)
8	Ground
9	Transmitter Voltage Supply

RS-422: The DIP switch settings for RS-422 are as follows:

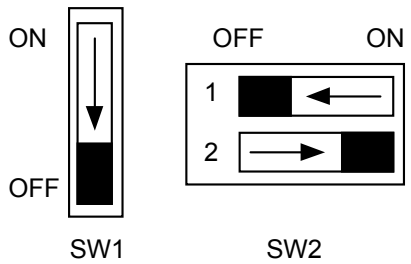


The terminal block wiring assignments are as follows:

Terminals	*Signal*
1	Ground
2	Receive Data Positive (Rx+)
3	Receive Data Negative (Rx-)
4	Transmit Data Positive (Tx+)
5	Do Not Connect
6	Transmit Data Negative (Tx-)
7	Do Not Connect
8	Ground
9	Transmitter Supply Voltage (Vtx)

Please note that the RS-422 setting is not guaranteed to work properly unless the Non-Intrinsically Safe 24-Volt power supply board is used with the Scanner 1131. This is due to the relatively high current required by the 422 line drivers for low impedance cable.

RS-485: The DIP switch settings for RS-485 are as follows:



The terminal block wiring assignments are as follows:

Terminal	*Signal*
1	Ground
2	Data Positive (Sig+)
3	Data Negative (Sig-)
4	Do Not Connect
5	Do Not Connect
6	Do Not Connect
7	Do Not Connect
8	Ground
9	Transmitter Supply Voltage (Vtx)

Please note that the RS-485 setting is not guaranteed to work properly unless the Non-Intrinsically Safe 24-Volt power supply board is used with the Scanner 1131. This is due to the relatively high current required by the RS-485 line drivers for low impedance cables.

Wiring Note: If this expansion board is located at one end of the two-wire RS-485 cable, then the switch settings, as shown, can be used. Should the CAO1 be located at a midpoint connection, then the 100Ω line termination resistor must be switched out. This is done by setting switch 2 on SW2 to the OFF position.

Scanner Settings

The Scanner 1131 hardware settings are the same as the two main board serial ports. Since the RS-422 and RS-485 settings do not offer terminals for Data Carrier Detect (DCD) and Clear to Send (CTS), make sure that the DCD/CTS hardware setting is set OFF.

Communications and Status (Digital) Input/Output (CDO1)

The 1131 CDO1 expansion board provides a single communication port (configurable as either RS-232, RS-485, or RS-422) as well as four digital channels which can be configured as either status inputs, status outputs, or pulse outputs.

Note: Use the Modbus protocol only on this port. Do ***not*** use ScanCom.

Specifications

General

Operating Temperature	-40°C to +60°C (-40°F to +140°F)
Storage Temperature	-55°C to +85°C (-67°F to +185°F)
Relative Humidity	0 to 95% RH non-condensing
Certifications	Individual circuits CSA approved for intrinsically safe operation in Class 1, Division 1 Group D areas when used with appropriate barriers.

Serial Communications

Quantity	One
Interface	Switch selectable as RS-232C, RS-422, or RS-485
Available Signals	RS-232C: Rx, Tx, RTS, CTS, DCD, and DTR
	RS-422: Tx+, Tx-, Rx+, and Rx-
	RS-485: Signal+, Signal-
Baud Rates	110, 150, 300, 600, 1200, 2400, 4800, or 9600 baud, software selectable
Parity	Even, odd, or none, software selectable
Stop Bits	1 or 2, software selectable
Function	Printer, remote console, or gas chromatograph port
Protection	Surges to 500 W at 1 msec. plus DC overload to ±40 V

Status Inputs and Status/Pulse Outputs

Quantity	Four
Input Voltage	+40 Vdc maximum
On-State Current	100 mA Maximum (status or pulse output)
On-State Resistance	20 Ω typical at 25°C (75°F) (status or pulse output)
	25 Ω maximum at 25°C (75°) (status or pulse output)
Maximum Pulse Rate	8 counts/second at 50% duty cycle (pulse output)
Off-state Leakage	<100 µA at +40 V (status input, jumper removed)
	<2000 µA at +40 V (status input, jumper installed)

Status Inputs Signal Levels

Maximum Low Level Signal	Nominal Threshold	Minimum High Level Signal
2.0 V	3.0 V	4.0 V
5.0 V	7.0 V	9.0 V
8.0 V	10.0 V	12.0 V

Function — Alarm or controller output (status output mode)
Totalized count output (pulse output mode)
Alarm or controller input (status input mode)

Protection — Optically isolated, polarity protected, surge protected to 500W for 1 msec.

Field Wiring Termination

Serial Interface Termination			
Terminal	**RS-232C**	**RS-485**	**RS-422**
1	Signal Ground	Signal Ground	Signal Ground
2	TX	SIG+	RX+
3	RX	SIG-	RX-
4	RTS	N.C.	TX+
5	CTS	N.C.	N.C.
6	DTR	N.C.	TX-
7	RLSD	N.C.	N.C.
8	Signal Ground	Signal Ground	Signal Ground
9	Transmitter Supply	Transmitter Supply	Transmitter Supply
I/O Signal Description			
10	Status In/Status Out/Pulse out #1 signal+		
11	Status In/Status Out/Pulse Out #1 signal-		
12	Status In/Status Out/Pulse Out #2 signal+		
13	Status In/Status Out/Pulse Out #2 signal-		
14	Status In/Status Out/Pulse Out #3 signal+		
15	Status In/Status Out/Pulse Out #3 signal-		
16	Status In/Status Out/Pulse Out #4 signal+		
17	Status In/Status Out/Pulse Out #4 signal-		

Options

- Industry Canada Switch Stuffing (Configuration Lock). Once locked, the port assignment for this board cannot be changed accidentally
- Uninterrupted Vtx (to a low power relay)
- The remote console expansion board that plugs into the lower pins of expansion slot B can also be plugged into the CD01 expansion board.

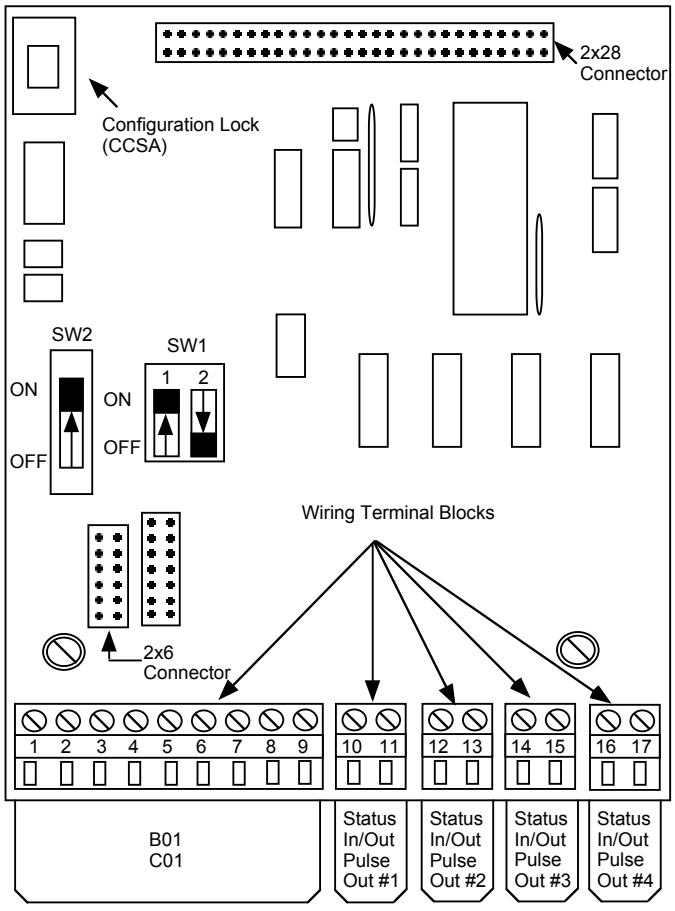
Installation

The CD01 expansion board mounts over the 1131 main board on either the left-hand side resource “B” connection, or on the right-hand side resource “C” connectors.

Place the CD01 card so that the terminal strips are facing down toward you. Align the pins with the sockets and push down firmly. Ensure that the sockets fully cover all the pins and are not offset by one pin location. Two captive screws fasten the board securely to two standoffs on the main board.

Wiring Diagram

The following diagram shows the terminal numbers and the corresponding resource allocations for the CD01 inputs and outputs.



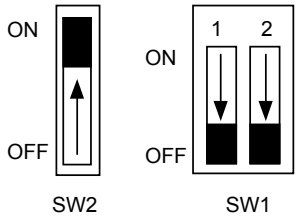
CDO1 Setup

Communications (Terminals 1-9)

The communications serial port can be set to an RS-232C, RS-422, or RS485 electrical configuration. This is done by setting the DIP switches properly.

Note:	It is ***not*** recommended that the ScanCom protocol be used with this serial port. Use Modbus instead.

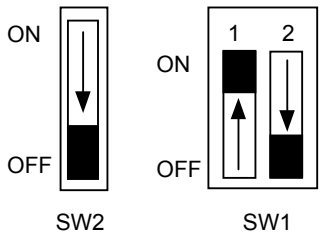
RS-232C: The DIP switch settings for RS-232C are as follows:



The terminal block wiring assignments are:

Terminal	*Signal*
1	Ground
2	Transmit Data (Tx)
3	Receive Data (Rx)
4	Ready to Send (RTS)
5	Clear to Sent (CTS)
6	Data Terminal Ready (DTR)
7	Data Carrier Detect (DCD)
8	Ground
9	Transmitter Voltage Supply (Vtx)

RS-422: The DIP switch settings for RS-422 are as follows:

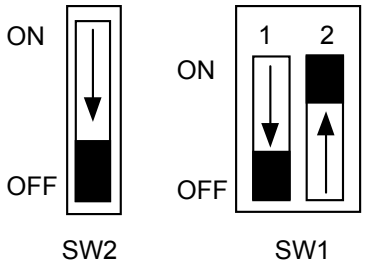


The terminal block wiring assignments are:

Terminal	Signal
1	Ground
2	Receive Data Positive (Rx+)
3	Receive Data Negative (Rx)
4	Transmit Data Positive (Tx+)
5	Do Not Connect
6	Transmit Data Negative (Tx-)
7	Do Not Connect
8	Ground
9	Transmitter Supply Voltage (Vtx)

Please note that the RS-422 setting is not guaranteed to work properly unless the Non-Intrinsically Safe 24-Volt power supply board is used with the Scanner 1131. This is due to the relatively high current required by the 422 line drivers for low impedance cables.

RS-485: The DIP switch settings for RS-485 are as follows:



The terminal block wiring assignments are:

Terminal	Signal
1	Ground
2	Data Positive
3	Data Negative
4	Do Not Connect
5	Do Not Connect
6	Do Not Connect
7	Do Not Connect
8	Ground
9	Transmitter Supply Voltage (Vtx)

Wiring Note:

If this expansion board is located at one end of the two wire RS-485 cable, then the switch settings can be used as shown. Should the CD01 be located at a midpoint connection, then the 100Ω line termination resistor must be switched out. This is done by setting switch 2 on SW1 to the OFF position.

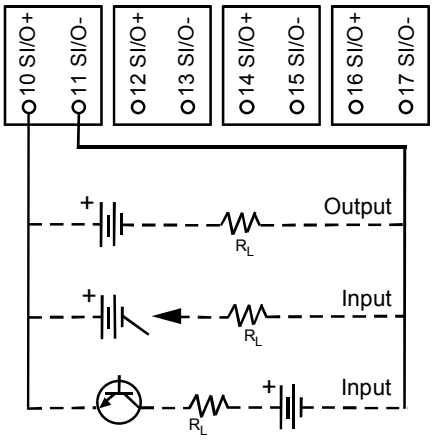
Please note that the RS-485 setting is not guaranteed to work properly unless the Non-Intrinsically Safe 24-Volt power supply is used with the Scanner 1131. This is due to the relatively high current required by the RS-485 line drivers for low impedance cables.

Digital I/O Circuits (Terminals 10-17)

The following table shows the field termination for the four digital I/O circuits:

Terminal	*Signal Description*
10	Status In/Status Out/ Pulse Out #1 signal +
11	Status In/Status Out/Pulse Out #1 signal -
12	Status In/Status Out/Pulse Out #2 signal +
13	Status In/Status Out/Pulse Out #2 signal -
14	Status In/Status Out/Pulse Out #3 signal +
15	Status In/Status Out/Pulse Out #3 signal -
16	Status In/Status Out/Pulse Out #4 signal +
17	Status In/Status Out/Pulse Out #4 signal -

Except for one difference, the digital I/O channels function identically and have the same specifications as the status inputs/outputs on the main board. See **pages 48**, **49** and **127**. The one difference is that the digital I/O channels are individually isolated from the communications terminal block (resources 1-9), as well as from each other, to allow them to be treated as separate intrinsically safe circuits. This allows all of the circuits to be connected to safe area equipment without running into energy limitations imposed by multiple barrier outputs. However, adequate physical segregation of the field wiring must be made so that the wiring faults will not be considered in the I.S. analysis.



Scanner Settings

The Scanner 1131 hardware settings are the same as the two main board serial ports. Since the RS-422 and RS-485 settings do not offer terminals for Data Carrier Detect (DCD) and Clear to Send (CTS), make sure that the DCD/CTS hardware setting is set to OFF.

Status I/O, Pulse I/O Digital Channels (DIO1)

The 1131 DIO1 expansion board provides up to five digital channels that can individually be configured as either status inputs, pulse inputs, status outputs, or pulse outputs. Options that must be specified at time of ordering include:

- 2 or 5 channels
- Standard accuracy for accumulating pulses inputs from turbine/ PD meters or high accuracy for use with the high frequency output from a densitometer
- With or without phase discrimination / pulse comparator (Level B Security as per IP 252/76)

Each channel is independently optically isolated, and is designed to be Intrinsically Safe for operation in Class I, Division 1, Group D areas when used with appropriate barriers. Each channel and the circuitry it uses are configured through two sets of DIP switches. SW1 through SW5 (see board layout diagram) are used to set the threshold voltage for each corresponding channel (SW1 is used for channel 1; SW2 is used for channel 2, etc.). SW6 through SW10 are used to set the mode for each channel (SW6 is used for channel 1; SW7 is used for channel 2, etc.).

When optionally supplied with the phase discrimination / pulse comparator circuitry, channels 2 and 4 are individually configured to serve as pulse comparators for the sequence of pulses on channels 1 vs. 2 and 3 vs.4. Monitoring provides continuous comparison of number, frequency, phase, and sequence of the two trains of pulses. At the same time, interfering pulses are also detected and a low frequency cutoff feature eliminates false error detection during flow startup and shutdown.

As a function of this same pulse comparator circuitry, channels 2 and 4 can provide phase discrimination to detect flow direction with turbine meters that have dual pickup coils.

The digital discriminators can detect pulse trains that are electrically 90° out of phase.

Note: Due to limitations imposed by the energy of multiple, Intrinsically Safe circuits in a single enclosure, certification may be limited to operation with one or two circuits only. This limitation is based on the total number of intrinsically safe circuits, which are connected to the Scanner 1131. (See the I.S. connection drawings found in Appendix A of this manual).

Specifications

General

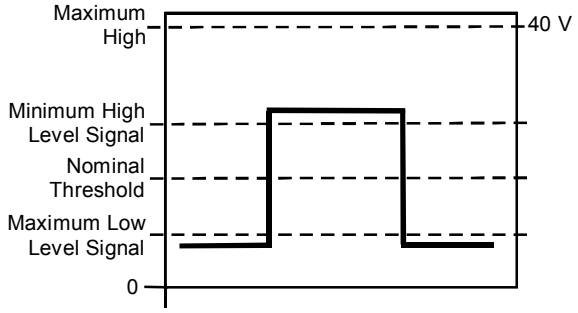
Operating Temperature	-40°C to +60°C (-40°F to +140°F)
Storage Temperature	-55°C to +85°C (-67°F to 185°F)
Relative Humidity	0 to 95% RH non-condensing
Certifications	Individual circuits designed for CSA I.S. approval in Class I, Division 1, Groups C and D areas when used with appropriate barriers.

Status and Pulse Input

Quantity	5 Maximum
Input Voltage	+40 Vdc Maximum
Input Current	Current limited @ 2.5 mA nominal
Input Signal Levels:	

Maximum Low Level Signal	*Nominal Threshold*	*Minimum High Level Signal*
0.50 V	1.0 V *	1.50 V
1.5 V	3.0 V	4.5 V
5.0 V	7.0 V	9.0 V
8.0 V	10.0 V	12.0 V

* Not optically isolated.



Pulse Input Frequency	0 to 10 kHz
Measurement Accuracy	± 1 Count (totalization)
	± 0.001 % of reading @ 25°C (75°F) (1 Hz-10Hz) (precision input option)
	± 0.1 Hz ± 0.1 % of reading over temperature (standard input)
Temperature Effect	± 0.01% of reading from -40°C to +60°C (-40°F to +140°F) (precision input)
Pulse Input Update Rate	5 seconds maximum for all channels
Protection	Optically isolated, polarity protected & surge protected to 300 W for 1 msec.

Phase Discriminator

Quantity	2 Maximum
Function	Compares phase relationship of inputs 1 vs. 2 and 3 vs. 4
Phase Accuracy	± 15°C (59°F)
Operating Frequency	1 Hz to 10 kHz

Pulse Comparators

Quantity	2 Maximum
Function	Continuous comparison of two pulse trains for sequence and phase, as well as detection of simultaneous interfering pulses, with a latched alarm generated if an error is detected. Programmable low frequency cutoff prevents false alarms during flow startup or shutdown.
Operating Frequency	1 Hz to 10 kHz

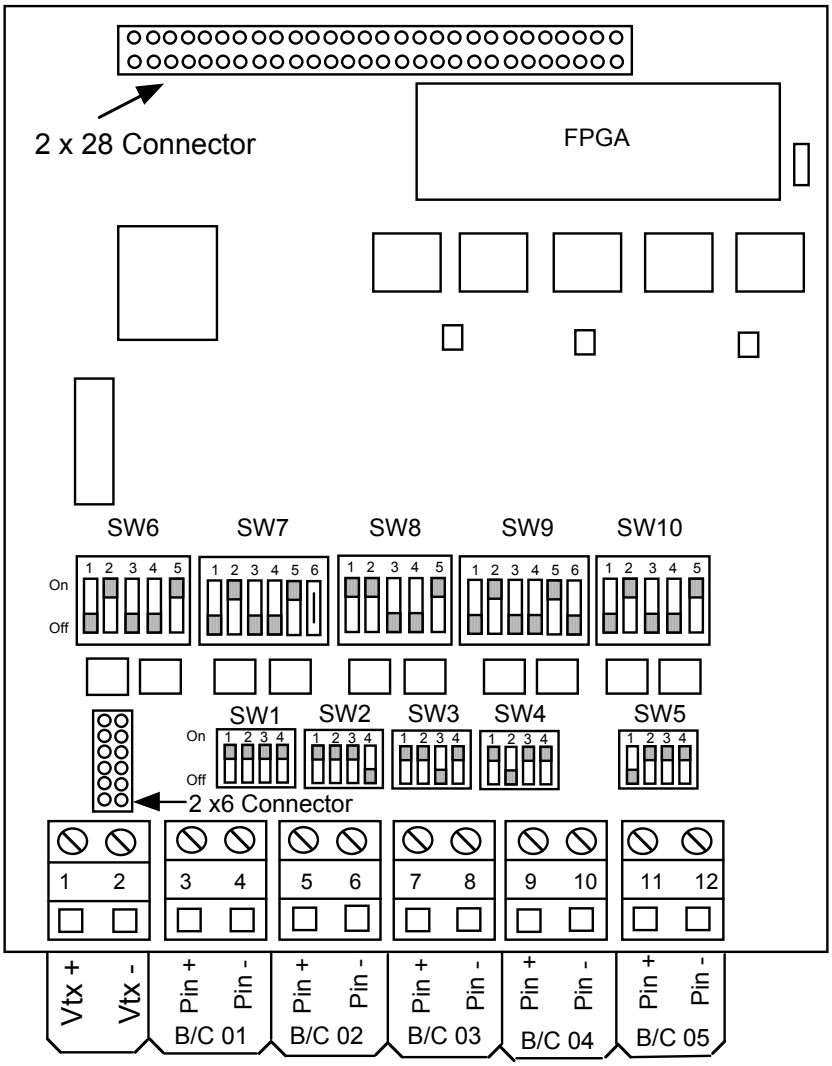
Status and Pulse Output Specifications

Input Voltage	+40 Vdc Maximum
On-State Current	100 mA Maximum @ 25°C (75°F)
On-State Resistance	25 ohms Maximum @ 25°C (75°F)
Maximum Pulse Rate	8 pulses/second @ 50 % duty cycle
Off-State Leakage	< 100 μA @ +40 V - 25°C (75°F)
Protection	Optically isolated and surge protected to 300 W for 1 msec.

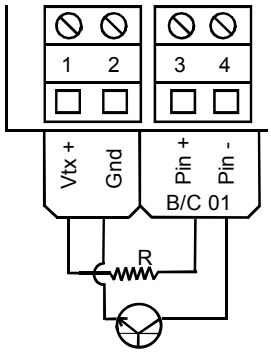
Installation

The DIO1 board can be installed in either (or both) expansion locations on the 1131 main board. As with all 1131 expansion cards, the system automatically recognizes its presence, as well as the type of card and its manufacturing configuration. In addition, the remote terminal interface boards (RTI1 and RTI2) can be plugged in on top of a DIO1 card when installed in the left-hand location (Slot B) to allow parallel access to the console serial port.

Wiring Diagram and Board Layout



Note: For **contact** or **open collector** inputs, voltage can be applied as shown below or externally:



Resistance is calculated based on the voltage (Vtx, 10V or 24 V) and the threshold.

$$R = \frac{\Delta V}{I} = \left(\frac{MinimumSupply - ThresholdMinHigh}{MinimumCurrent} \right)$$

Example: For 24 Vdc supply $= \frac{20 - 9}{2.5mA} = 4.4k\Omega \text{max.}$

= 2 to 4 k Ω

Circuit Description

I/O Circuit Description

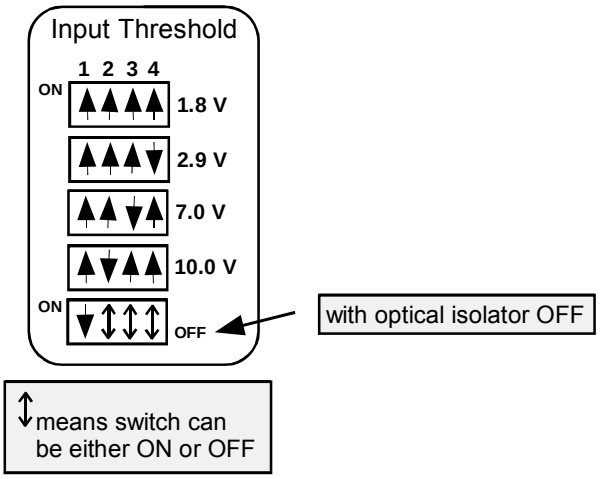
Each of the 5 channels provide an optically isolated input that can be configured to various modes and threshold voltage levels, depending on the type of the incoming pulses. This conditions the circuit to interface with external pulse preamplifiers, contact closures, and logic level signals. All 5 channels are identical, with the exception of channels 2 and 4 which have an additional mode switch to allow for the detection of positive and/or negative going pulses from many mass flow / density meters.

Each channel has 2 separate blocks of DIP switches used for configuration which can be identified as follows (also refer to board layout diagram for placement on the circuit board – **page 80**):

Channel	*Threshold Level Switches*		*Mode of Operation Switches*	
1	SW1	(4 switch block)	SW6	(5 switch block)
2	SW2	(4 switch block)	SW7	(6 switch block)
3	SW3	(4 switch block)	SW8	(5 switch block)
4	SW4	(4 switch block)	SW9	(6 switch block)
5	SW5	(4 switch block)	SW10	(5 switch block)

Threshold Level Switches (SW1 through SW5)

These switches select the threshold level of the input when used in the optically isolated mode. In the non-isolated mode (input threshold 1.5V), these switches do not affect the performance of the channel in any way (see section on **Mode of Operation Switches (SW6 through SW10)**).



The "OFF" threshold selection is used when the channel is being used in non-isolated mode, as a digital output channel, or when the channel is not being used at all. Turning it off will conserve the 2 mA per channel required to power the optic isolator.

Note: ***Threshold*** Switch 1 should **ALWAYS** be in the same position as ***Mode*** Switch 2.

Mode of Operation Switches (SW6 through SW10)

These switches are used to configure the mode of operation of each of the channels. Some of the different "modes" include:

- Optically isolated input vs non isolated
- Routing the input signal through a debounce circuit for eliminating the chatter associated with mechanical contact closure devices
- Routing the input signal through the pulse comparator circuit for use with Level B Security or Phase Discrimination applications
- Routing the input signal through BOTH the input isolator and the pulse comparator

Switch	*ON*	*OFF*
1	Pulse input is "debounced" Max frequency is 10 Hz.	Pulse input is full bandwidth Max frequency is 10 kHz.
2	Optical isolation ON	Optical isolation OFF for use as a Non-isolated input or as a pulse / digital output
3	Connects the +ve input of the signal to the pulse comparator	Disconnects the +ve input from the Main circuit, forcing the use of Optical isolation (i.e. Switch 2 ON)
4	Connects the -ve input of the signal to the pulse comparator	Disconnects the -ve input from the Main circuit, forcing the use of Optical isolation (i.e. Switch 2 ON)
5	Output of optical isolator is connected to the pulse comparator (i.e. Switch 2 ON and pulse comparator is required)	Output of isolator is disconnected from the pulse comparator (i.e. Switch 2 OFF or pulse comparator is not required)
6 (Channels 2 and 4 only)	Sets the polarity of the threshold For the detection of –ve going Pulses (i.e. Threshold= -1.0 V) when in non-isolated mode (Switch 2 OFF)	Sets the polarity of the threshold For the detection of +ve going Pulses (i.e. Threshold= +1.0 V) when in non-isolated mode (Switch 2 OFF)

NOTES: Switches 2 and 5 will **ALWAYS** be in the same relative position and in the opposite position to Switches 3 and 4. (i.e. 2 and 5 **ON** with 3 and 4 **OFF** or 2 and 5 **OFF** with 3 and 4 **ON**)

Switch 6 is **ALWAYS** in the ***OFF*** position except when used with densitometer applications.

Phase Discriminator and Level B Pulse Security

Note: Phase Discrimination and Level B security are only available on version 2.x and 3.x firmware with ScanPC user interface. They are not available on version 4.x firmware with ScanWin user interface.

Channels 1 / 2 and 3 / 4 can be used for Phase discrimination and Level B Security. To facilitate this application, the inputs must be used in pairs (i.e. channel 1 would measure one pulse stream from a meter and compare the signal to channel 2 measuring the second pulse stream from that same meter. Similarly, channels 3 and 4 are used together).

When the pulse comparator is enabled through the Mode of Operation Switches as detailed in the previous section, **Mode of Operation Switches (SW6 through SW10)**, a unique hardware type is created in the Scanner application firmware that differs from a normal pulse input hardware resource. This unique hardware type is called a Pulse In LB/PD (Level B / Phase Discrimination) and it has some additional attributes that are not available in a standard pulse input hardware resource. The additional attributes are as follows:

Attribute	*Units*	*Description*
LB Cutoff:	Hz	A user entered "Level B" low frequency cutoff, which prevents alarms from being flagged during start-up or shutdown.
Phase=	Degrees	A live input indicating the phase shift between the two pulse streams being compared. Note that the sign (+/-) indicates whether the shift is leading or lagging.
LB Alarm…	N/A	The latched alarm state of the "Level B" alarm (either ON or OFF). To reset or acknowledge the alarm, press PAGE DOWN and follow the instructions

1131 Phase Discrimination Configuration Procedure

To configure the 1131 for Phase Discrimination:

1. Install DIO1 board into either Slot B or Slot C.
2. Superboot the Scanner (**page 31**).
3. Create a flowrun named ***FORWARD***. Configure it so that
   - Primary Device > **Volume Pulse Meter**
   - Device Type > "**Standard**" ("Level B" if level is required)
   - Flow Direction > **Forward**
4. Create another flowrun named ***REVERSE***. Configure it so that
   - Primary Device > **Volume Pulse Meter**
   - Device Type > "**Standard**" ("Level B" if level is required)
   - Flow Direction > **Reverse**
5. From the **Hardware** page, assign Resource CO1 as a Pulse in LB/PD. Resource Co2 will automatically switch to a pulse-in when CO1 is assigned for phase discrimination.
6. Assign resources in the Forward flowrun (Qf (uncorrected rate) is assigned to resource CO1; the rest of the variables are assigned accordingly).
7. Assign resources in the Reverse flowrun (Qf (uncorrected rate) is assigned to resource CO1; the rest of the variables are assigned as in the Forward flowrun).

Note: If KFactor is the same in ***BOTH*** directions, assign to CO1; if KFactor is ***different***, then assign to CO2 resource.

8. Set DIP switch settings as indicated in the manual.

Level B Pulse Security

Level B Security, in accordance with the Institute of Petroleum IP252/76, requires:

"*Continuous* monitoring, error indication and alarm signaling by methods of comparison...This level of security is intended to give *warning* of transients and other spurious (artificial) influences, supply borne and radiated, in addition to functional errors and failures."

Further stated under the Level B Block Diagram:

"The diagram illustrates a dual transmission system with a dual pulse comparator in which the pulse trains are continuously monitored for number, frequency, phase, and sequence, and any irregularities indicated. Simultaneous interfering pulses must be detected and indicated. An alarm is given if pulses are lost or gained on either channel."

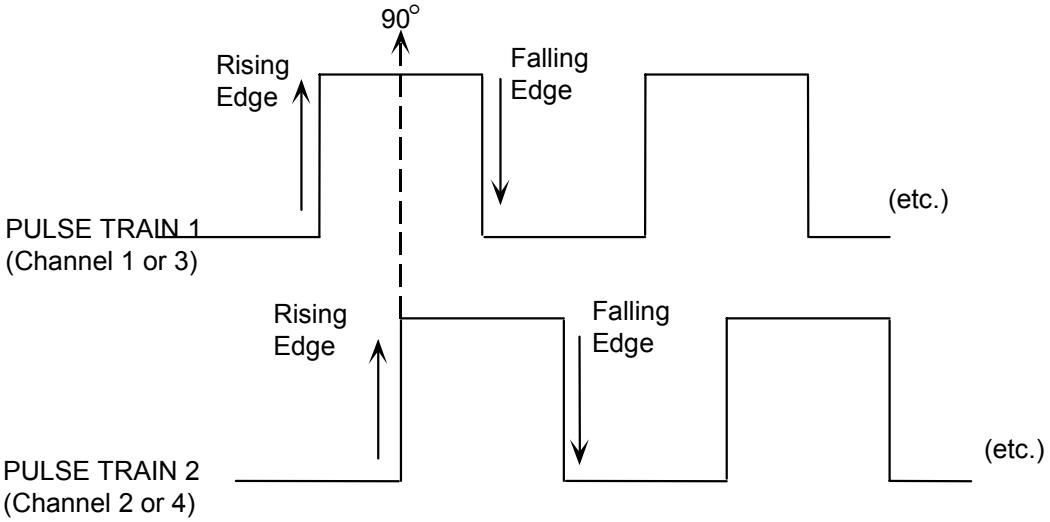
This security is generally used on custody transfer liquid metering applications to detect missing rotor blades on a turbine meter. When an error is detected, the application software in the Scanner latches the "LB Alarm" (Level B) at the pulse input hardware level. The alarm must be acknowledged manually to clear the alarm- this is accomplished by pressing the *PAGE DOWN* key from the LB Alarm in the hardware page for the pulse input.

Phase Discrimination

When connected to a dual pick-up turbine meter, where the pick-ups are separated to provide an electrical 90° phase shift, the difference in the pulse trains on each channel allows the Scanner to determine the direction of flow. The application is configured by building two flowruns in the Scanner firmware- one set as FORWARD and the other as REVERSE. The pulse input on these two flowruns must be linked to the appropriate hardware resource on the DIO1 board (either channel 1 and 2 or channel 3 and 4). When the phase shift is positive or leading, the pulse stream will be directed towards the FORWARD flowrun; when it is negative or lagging it will be directed towards the REVERSE flowrun. Each of the flowruns will accumulate separately.

Additionally, if there are any missing pulses from either pulse train, an error will be flagged (LB Alarm= ON). This is because the phase discrimination is a function of the pulse comparator or Level B Security circuit. This type of alarm might also be indicative of a bad pick-up coil, pre-amplifier, or wiring fault between the turbine meter and the Scanner.

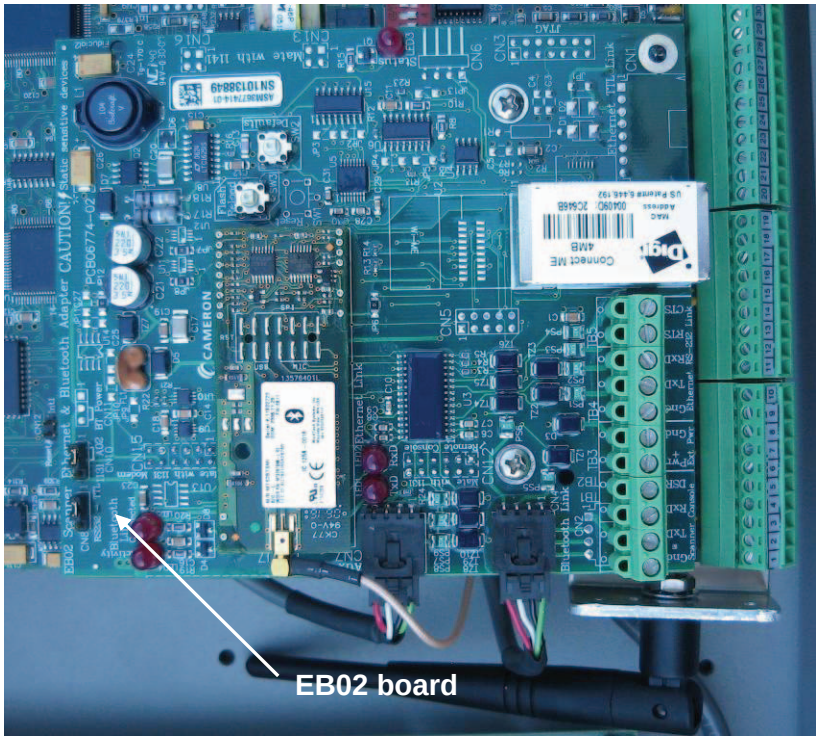
The following diagram illustrates Phase Discrimination:



The fact that Pulse Train 1 is leading Pulse Train 2 is interpreted by the Scanner as flow in the FORWARD direction. If Pulse Train 2 were leading Pulse Train 1, it would be REVERSE flow.

Ethernet–Bluetooth Expansion Board (EB02)

The EB02 expansion board provides the Scanner 1131 EFM/RTU with Ethernet and Bluetooth communication interfaces. The board mounts in the Slot B expansion board location using connector CN10 and CN7 on the Scanner 1131 board.



Scanner 1131 with EB02 Ethernet-Bluetooth board installed

Ethernet Communication

The EB02 ethernet board is a serial to TCP/ IP converter that supports transmission of the protocols supported by the Scanner including ScanCom, Modbus (ASCII and RTU) and Enron Modbus (ASCII and RTU), over TCP/IP. It also adds the capability of Modbus TCP by acting as a protocol translator between TCP/IP and the Scanner's Modbus networks.

The board supports multiple user-defined IP Ports. Therefore, one ethernet board can support multiple host connections with different protocols on each port.

The EB02 firmware includes a program that can interrogate the Scanner, extract user-defined data and store it in a file on the ethernet board for retrieval using standard FTP methods and software. The Ethernet module can store over 2 MB of historical records as SCM files, and with the use of a proprietary ScanFTP program, the data can be transferred by FTP from the Ethernet module to a PC from anywhere on the Wide Area Network at the speed of the Ethernet.

ScanFTP enhances standard FTP capabilities to fully support the capabilities of the Scanner EB02 board, and includes features such as a one-button download and the automated creation of directories to keep measurement data safe.

Bluetooth Communication

Bluetooth technology provides a secure, standards-based wireless connection between a host and Scanner 1100 EFM/RTU. The Class I board facilitates wireless data transfer at speeds up to 100 meters when communicating with another Class I device, eliminating the need for serial cable connections.

The board shares the console port, so no additional resources are required.

A 4-pin connector can be connected to the serial console port connector on the Scanner enclosure, enabling the Scanner's A01 console port to be used as either a Bluetooth wireless port or a serial communication with a cable.

Specifications

For a complete list of specifications and installation instructions, see the Barton Ethernet-Bluetooth Adapter Board User Manual, Part No. 9A-30165034.

4: Local Display Menu Path (NFlo & IGas 4.X)

Basic Operation

Moving the Cursor

Scanner operations are organized in a hierarchy and are viewed by the user in the form of a “page” on the local display. A page is comprised of a menu list of Scanner functions that the user can select. The top page of the hierarchy is the `Main Menu` page. The user can move through menu items on a page using the cursor.

The cursor can be moved from one line on a page to another with the ***line up*** and ***line down*** keys. These keys are available on most 1100 series Scanners. Although a page may be more than four lines long, only four lines of each page can appear on the local display. The ***line up*** and ***line down*** keys are also used to scroll the display.

Opening and Closing Pages

Choosing one of the selections on the `Main Menu` with the ***page down*** key results in a new page appearing on the display. Each depression of the ***page down*** key produces a new page containing more detailed information, and more page selections. Each path has a number of ***page down*** steps until no more page selections are possible. By moving through the pages in this way, any information or function is accessed rapidly in a logical manner.

The ***page up*** key “closes” the current page, causing it to collapse into a single line menu item on the previous page. Pressing the ***page up*** key enough times will always return the user to the `Main Menu`.

The escape (***esc***) key can also be used to close the current page or escape from a function entered in error.

The Measurement RTU uses four special characters to differentiate the types of item that appear on each page:

Character	Item Type	Example
=	Calculated or live values	`Qv= 123.4 CF/h`
*	Default	`Press* 0.00 kPa`
:	User entered value or text	`Name: Fred`
>	User selected (from a list)	`Day> Monday`

Selections that do not have associated characters (e.g. the `Main Menu`) are menu choices to alternate pages and do not accept the ***page down*** command.

Selections showing the characters "*****" or "**:**" indicate the end of a path and do not accept the ***page down*** command.

Calculated or Live Values

Selections that have an equal sign "**=**" character are values that cannot be changed by the user. Examples are calculated values, live inputs from hardware channels, and physical hardware such as switch positions. Selecting ***page down*** from a calculated value displays a page showing the values used in the calculation. Live inputs are at the end of a path and do not accept the ***page down*** command.

Default Values

Values marked with an asterisk "*****"are defaults. A default value is a substitute value that is temporarily being used in place of a live input, usually because of a transmitter failure or an out-of-range condition. Selecting the ***detail*** key allows the user to view the properties of that value.

Entered Text or Values

Selections showing a colon "**:**" are user-entered items. Examples are numeric constants, default values, and text (e.g., flowrun or data log names). To change a user-entered item, press the ***enter*** key in the new text or value, and press ***enter*** again.

Volume, mass, and energy totals are calculated values shown with a colon because they can be reset or changed to a user-entered value.

Selecting

Selections with a right-arrow character "**>**" are items which are user-selected from a list. Pressing the ***select*** key repeatedly scrolls through the options. The list scrolls in a circle. If the user misses the desired option, keep pressing ***select*** until it appears again. When the desired option appears, press the ***enter*** key. Units of measurement, wherever they appear, are always selectable.

"Details" Page

The ***detail*** key displays a detail page for the item highlighted by the cursor. A detail page contains help text and other information, depending on the nature of the item.

Function Keys

The following functions are accomplished in various ways using the Scanner keypads (***columns 3 and 4***) or a computer terminal (***column 5***). The ***second column*** shows the function as it is described in the page maps.

FUNCTION	SHOWN AS	STANDARD KEYPAD	EXTENDED KEYPAD	PC/AT
LINE DOWN	(not shown)	line	line	↓
LINE UP	(not shown)	line	line	↑
PAGE DOWN	→	page	page	PgDn
PAGE UP	(not shown)	page	page	PgUp
ESCAPE	(not shown)	page	page	ESC
SELECT	SEL →	units	select	→
ENTER	ENT →		enter	RETURN
DETAIL	DET →	detail	detail	End
DELETE	DEL →		back space	Del
YES	Y →		yes	Y
NO	N →		no	N
User-entered number	(num) →		NUMBER KEYS	NUMBER KEYS
User-entered text	(txt) →			TEXT KEYS
Time Delay	t →	automatic	automatic	automatic

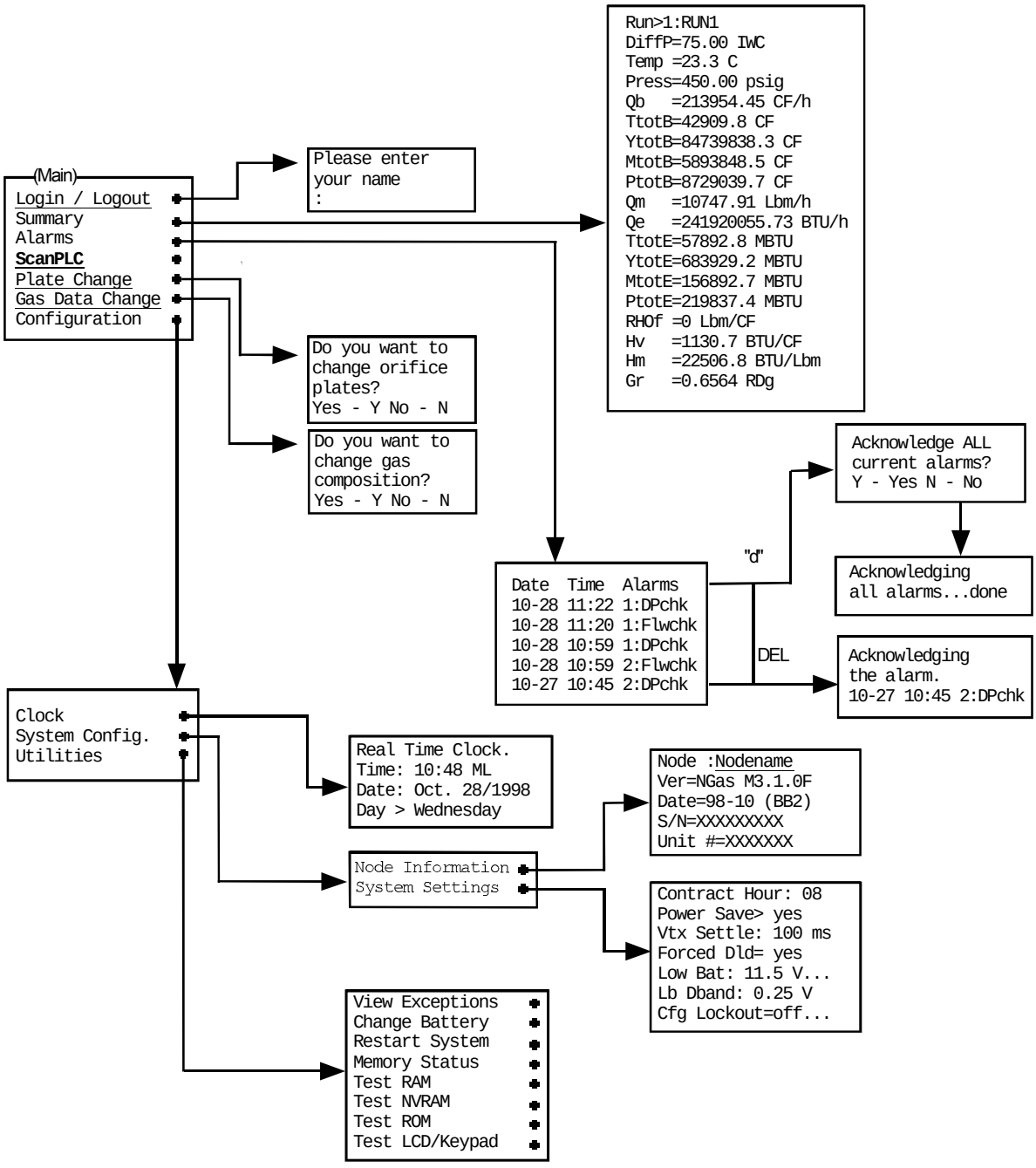
Display Units

Note that with firmware versions ***4.2.0 and later***, the ***detail*** and ***units*** keys can be used to set the display units.

Local Display Menu Paths

The following shows the local display menu paths for NFlo 4.X and IGas 4.X firmware. This is activated using a limited function and extended keypad by pressing the **mode** key to change from autoscroll mode to menu mode. The ScanPLC menu is only present with the "**P**" version of firmware (e.g., NFlo **P**4.X).

Note that the ***underlined*** menu items (**Login / Logout**, **ScanPLC**, **Plate Change** and **Gas Data Change**) can ***only*** be accessed with an ***extended*** keypad.



Summary Pages

Whenever a flowrun is created, a Summary page is also created. The Summary page is a list of the most important parameters, calculation values, and live measurements from the flowrun.

The contents of the summary page depend on which calculations were selected when the flowrun was created. The above example is based on a typical orifice flowrun. The summary page for a mass flowrun or a turbine (AGA-7) flowrun is different.

The ***units*** key on the local keypad scrolls to the summary page on the next flowrun. Alternately, the operator can switch directly to a different flowrun by typing that flowrun's one character flowrun ID number (1 through 8).

Press the ***detail*** key on the first item to display the flowrun details

Press the ***detail*** key with the cursor on any of the other items on this page to display a flowrun item details page

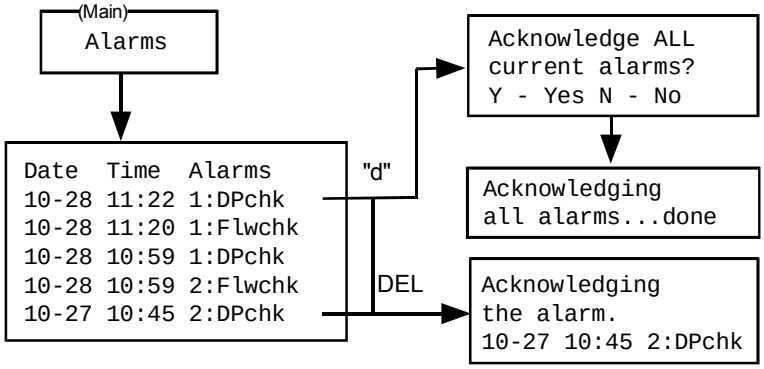
Alarms Page

This page displays all system and flowrun alarms. Hardware alarms appear when a hardware device goes out of range, and disappear when the device comes back into range. The symbol "*****" denotes automatic alarms. Flowrun alarms can be configured to be either user-acknowledging (latching), or self-acknowledging. Flowrun alarms are latched by selecting the latching option in the flowrun alarm screen.

The alarms page can contain a maximum of 30 alarms. Each alarm is logged with a date, time, description, and run number. The most recent alarms are displayed first. Older alarms are automatically acknowledged and removed from the list. The ↑ and ↓ keys can be used to scroll a screen at a time.

Alarm Acknowledgment

Latched alarms require acknowledgment to be removed from the alarms page. To acknowledge an alarm, move the cursor onto the alarm and press the ***del*** key. The user can also delete all the current alarms on the `Alarms` page by hitting the `"d"` key on the keyboard while using ScanPC. Simply hit the `"d"` key while in the `Alarms` page and answer `yes` to the `"Acknowledge ALL current alarms?"` prompt.



Alarms are logged in the event log twice: once when they occur and again when they are acknowledged (either by the user or automatically).

Alarm Types

The following examples can appear on the alarm page.

LBchk	Low battery check	Battery Voltage drops below 11.5 Vdc
DPchk	Differential pressure check	
VFchk	Volume flow check	
EFchk	Energy flow check	
MFchk	Mass flow check	
RAM	RAM checksum error	RAM memory fault.
NVRM	NVRAM checksum error	NVRAM memory fault.
ROM	ROM checksum error	ROM memory fault.

Alarm Status

If any active alarms are present when the terminal device is first connected, the following message appears (this message also appears on the local display when the Scanner is powered up):

```
  **WARNING**
Active alarms
are present.
See Alarm screen
```

Active alarms are also indicated on the local display by a special AL cursor that replaces the normal box cursor. Alarms that are still active cannot be deleted.

Orifice Plate Change

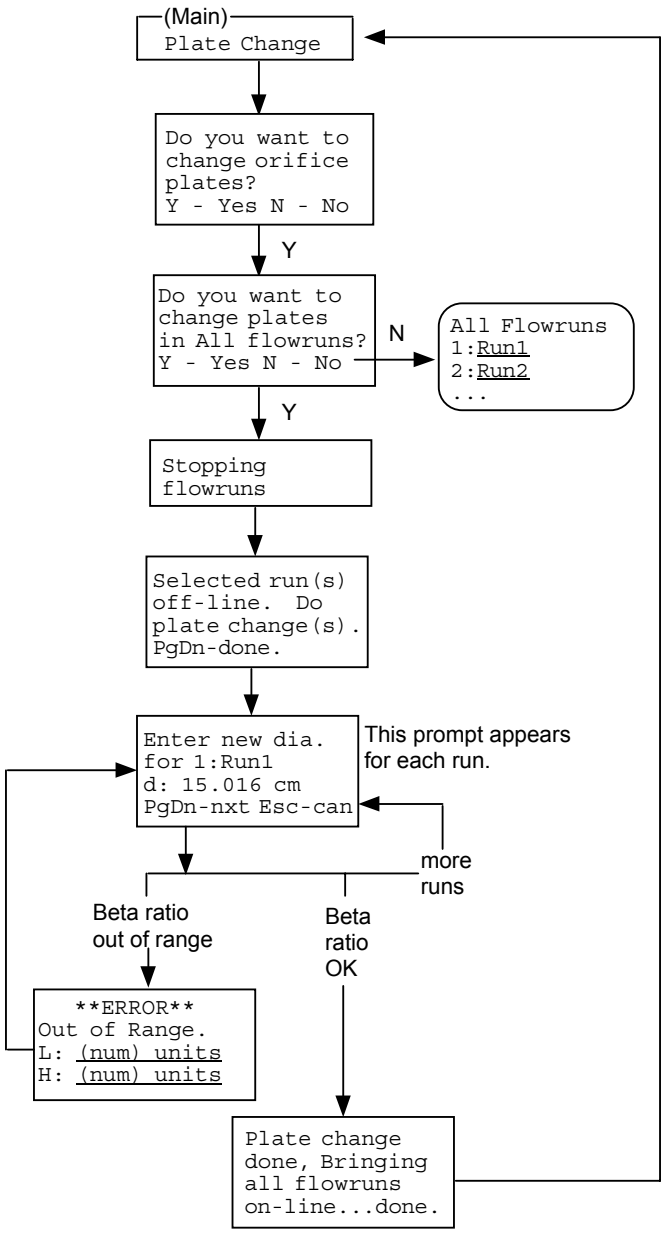
The Plate Change selection guides the user through an orifice plate change on either one, or all the meter runs. The runs being changed are switched off-line before the orifice change (status is changed from running to stopped). Provided the estimation feature has been enabled (Est on Platechg>yes -, turning the run OFF results in a flow estimation for the period the flowruns are off-line.

Note that if Est on Platechg *is OFF* (>no) *as it would be if the flow was actually stopped during the plate change, no volume would be estimated for the period until the plate change routine was completed.*

The flowrun status is always changed to running upon completion of the Orifice Plate Change routine regardless of its previous status.

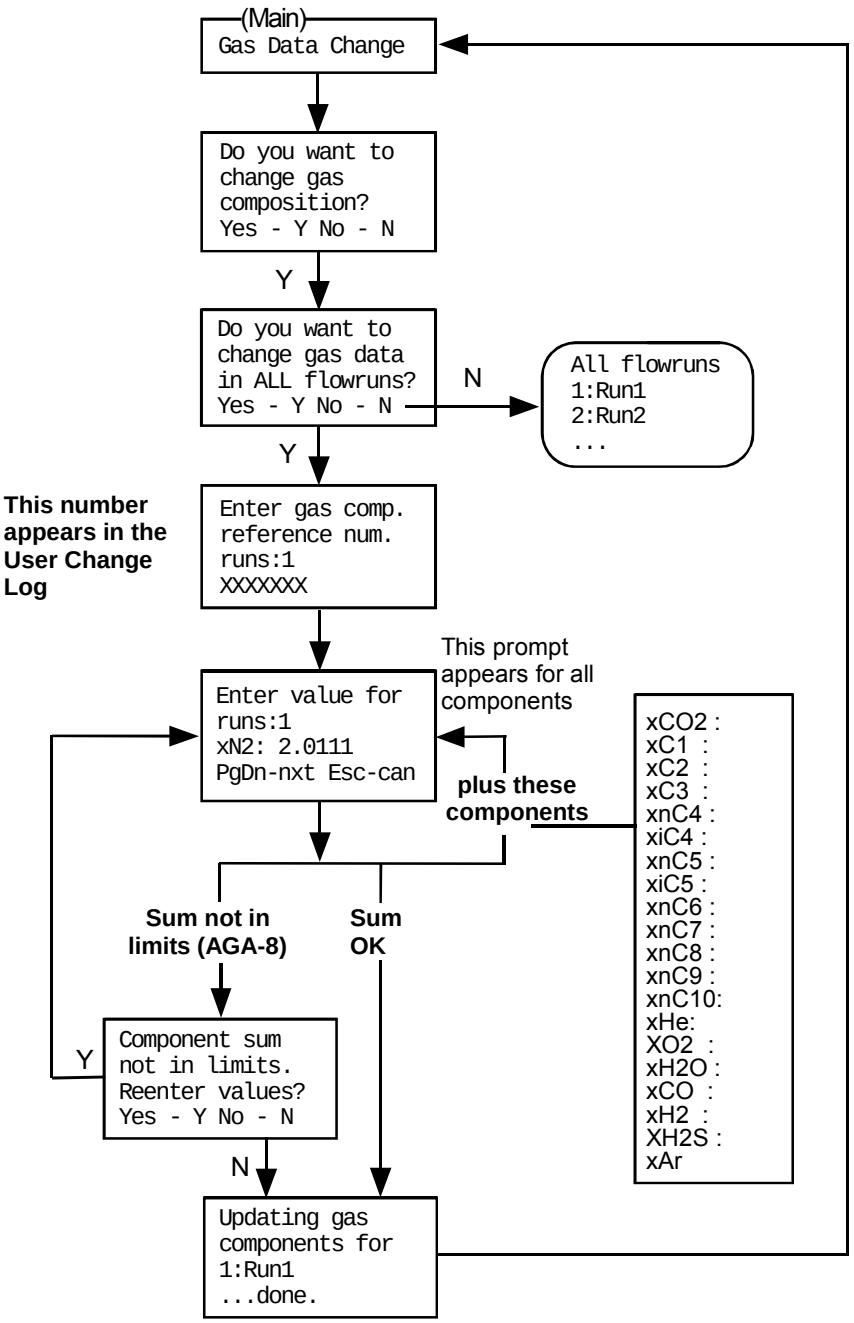
The Orifice Plate Change routine always records a user change for the orifice diameter "d," even if no change was made. The orifice diameter can also be changed without taking the run off-line by pressing ***page down*** from the flowrun item "d", but estimation will NOT occur and the flowrun may not begin using the new data until the next calculation cycle.

Note: If this routine is ***NOT*** completed, the flowrun could be left in an ***OFF*** state. It is therefore imperative to make sure that the flowruns are back on-line before disconnecting from the Scanner.


(Main)
Plate Change
Do you want to change orifice plates?
Y - Yes N - No
Y
Do you want to change plates in All flowruns?
Y - Yes N - No
N
All Flowruns
1:Run1
2:Run2
...
Y
Stopping flowruns
Selected run(s) off-line. Do plate change(s).
PgDn-done.
Enter new dia.
for 1:Run1
d: 15.016 cm
PgDn-nxt Esc-can
This prompt appears for each run.
more runs
Beta ratio out of range
Beta ratio OK
ERROR
Out of Range.
L: (num) units
H: (num) units
Plate change done, Bringing all flowruns on-line...done.

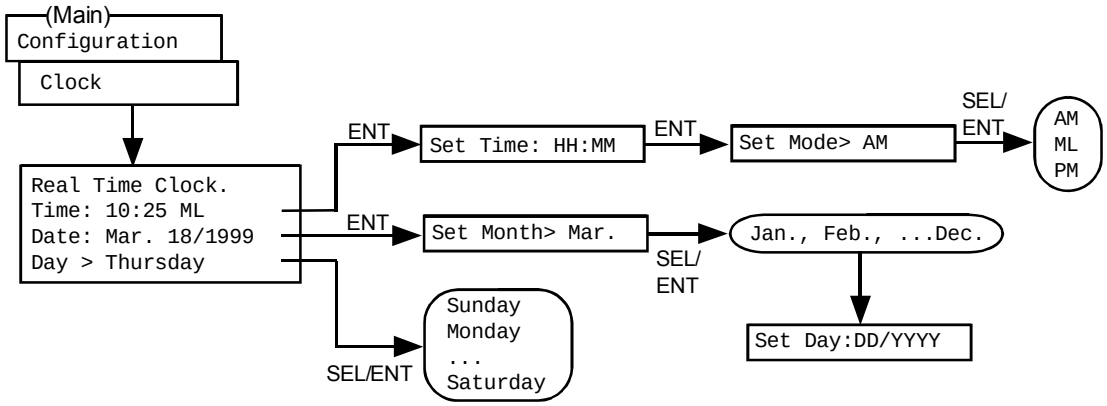
Gas Data (Composition) Change

The `Gas Data Change` selection guides the user through a gas composition change on one, or all the meter runs. The runs affected are switched off-line during the gas composition change (status is changed from `running` to `stopped`). Provided the estimation feature has been enabled, this results in a flow estimation for the period that the flowruns are off-line. The flowrun status is always changed to `running` upon completion of the Gas Data Change routine regardless of its previous status.



Clock / Calendar

The Clock page displays the time and date according to the flow computer's real time clock. This date and time are used by the computer to determine when reports and logs occur. The time can be displayed in AM/PM format or military 24-hour (ML) format.

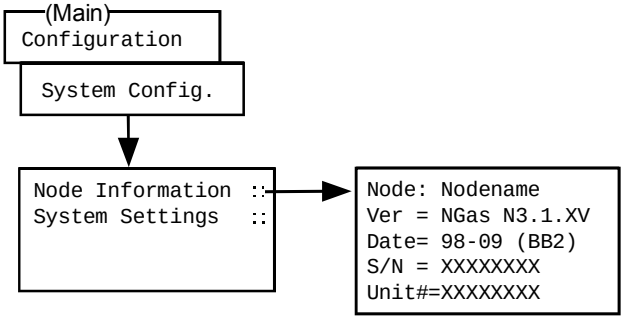


During a superboot, the system clock must be set before the Scanner can be used. This prevents the user from making configuration modifications following a superboot before the clock has been set. The message **Sorry** System must be set before use will be displayed and the screen will immediately switch to the clock screen. After setting the clock, operation continues normally.

System Configuration

Node Information

Node Information is accessed through the System Config. page.

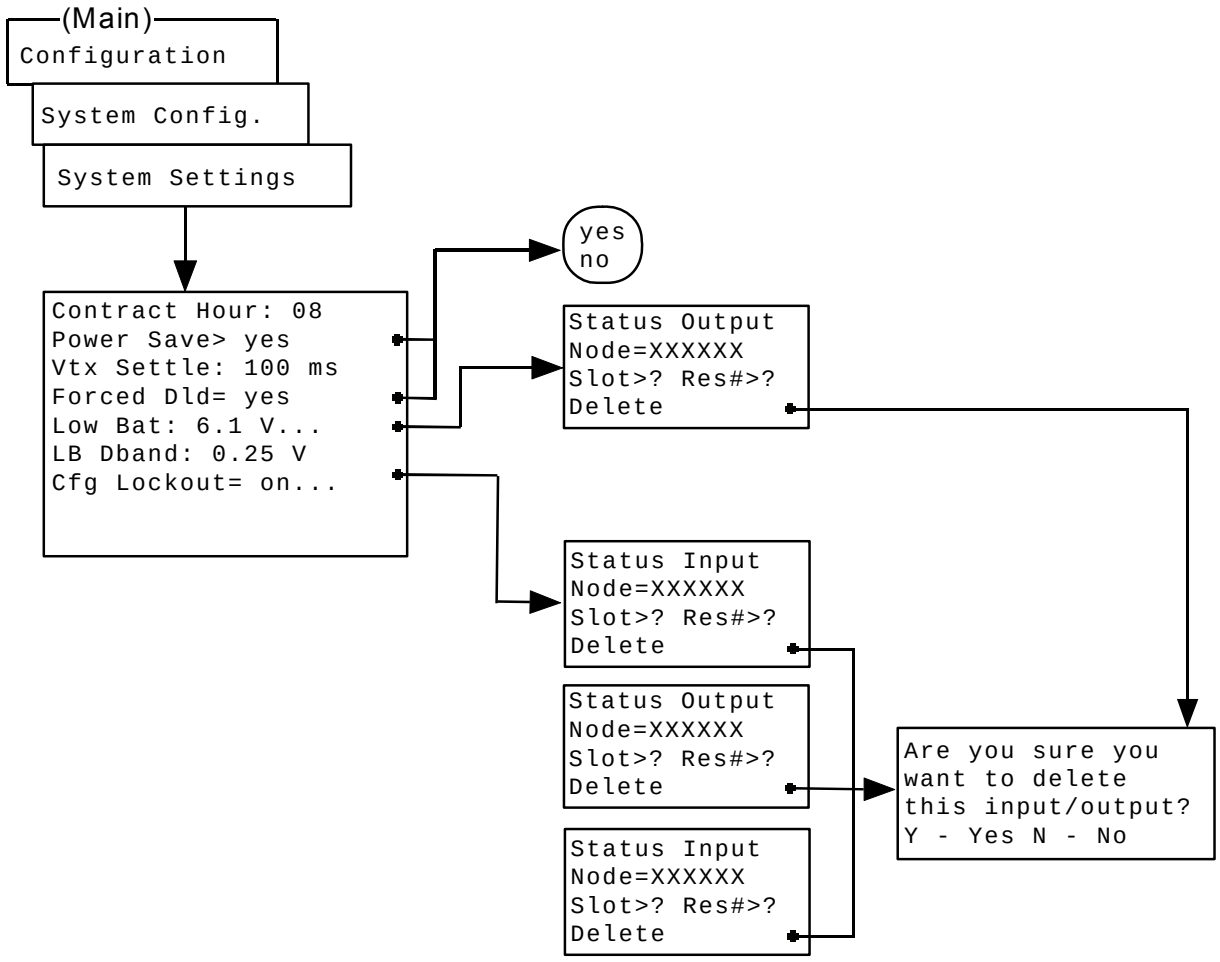


The Node name can be changed from this page. The Node name is used to identify the flow computer in logs, reports, etc. This initial Node name should be changed to some other unique name.

The software version (Ver), software Date, ROM serial number (S/N) and Flash boot block code version number (BB2) are also displayed here. This information should be recorded.

Systems Settings

The selections in the `System Settings` page apply to the complete flow computer system.



`Contract Hour` This is the hour (0-23) at which the next gas day starts. This is used in all Daily Histories.

`Power Save` To enable low power operation, simply change the setting of `Power Save` to `yes`.

`Vtx Settle` The settling time is used in power save mode to establish how long a transmitter takes to send a stable reading after it is turned ON. The default setting is `100 ms`.

`Forced Dld` Setting this to `yes` prevents user changes from taking place when the User Change Log is full and needs to be downloaded. The following message appears if user changes are attempted with a full User Change Log:

```
Access Denied
for user
XXXXXX
D'load User Log
```

This feature cannot be disabled (i.e. set to `No`). All Consumer and Corporate Affairs of Canada (CCAC) approved software must have `Forced Dld` fixed at `yes`.

`Low Bat` The Low Battery threshold can be changed based on which power supply is used. For an 1131, the default is set to 11.5. A low battery alarm can be assigned to a status output by paging down from the `Low Bat` line. This status output will activate only if a low battery alarm is found in the alarm queue.

`LB Dband` The low battery alarm deadband will not allow the low battery alarm to disappear until the voltage has climbed above the deadband.

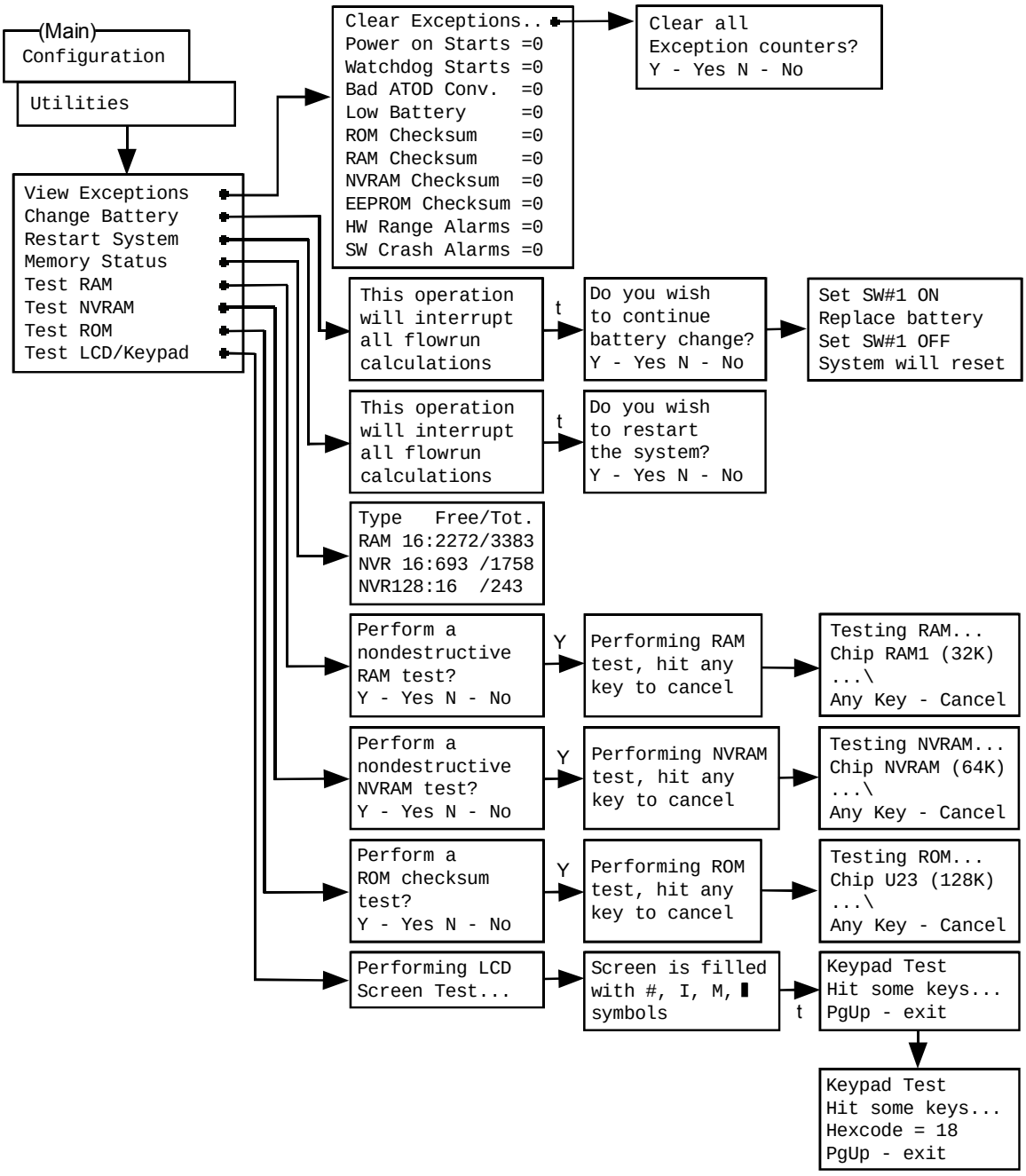
`Cfg Lockout` When configured, the configuration lockout uses a status input to read the Industry Canada Configuration Lock switch. The configuration lock switch will prevent the following user actions if it is switched ON:

- Add/Remove/Modify flowruns
- Superboot

Paging down from the `Cfg Lockout` line yields a standard `node/slot/port` selection screen. Selecting a resource as the configuration lockout switch input will prevent all users from making changes to the status input hardware settings. The user should be sure to set the proper input threshold before assigning the lockout switch.

Utilities

The Utilities page provides maintenance and test functions for the flow computer. The contents of this page are not related to flowrun calculation; however, they are basic functions to view the operative functionality of the flow computer.



View Exceptions	Nine system exception counters are shown, each incremented whenever an exception occurs. The counters do not wrap around to zero, but read 255 when the counter is overrun or full. The user may clear all exception counters only if read/write access has been assigned to the page.
Change Battery	This allows the user to change the battery and reset the system properly.
Restart System	This is a method of properly resetting a battery operated Scanner. It performs a "warm" start by causing a watchdog reset of the Scanner. This has the same effect as cycling the power OFF and then ON again (refer to **page 35**).
Memory Status	Displays a summary of memory usage relative to the total memory of the flow computer
Test RAM	These perform non-destructive tests on the RAM and NVRAM.
NVRAM, ROM	It also does checksum checks on the ROM. These tests do not affect the configuration or other data. Use the ***esc*** key to cancel these tests.
Test LCD/Keypad	This performs a test of the LCD and keypad. The ***page down*** button of the local keypad initiates a routine which fills the local display with `#,` and the `I,` and then `M` symbols and finally a black display. After the display test, the user is prompted to `Hit some Keys`. While the key is depressed the Hexadecimal code for the key is displayed. ***Page down*** returns the user to the `Utilities` page.

5: Troubleshooting

This section defines a basic procedure for locating Scanner 1131 Hardware operating problems.

Analog Inputs and Outputs

Perform the following procedure to check the operation and to verify the accuracy of the Scanner 1131.

1. Connect a voltmeter across “Vtx” and “Gnd” to read the voltage supplied to the transmitter(s). If the transmitter(s) are in power-save mode, the power to the transmitter(s) is turned on only long enough to read the transmitter at an operator-configured interval of “Avg. every” seconds (refer to **Timing Page** in software and/or firmware manuals). Transmitter voltage “Vtx” can be adjusted (refer to **Power Supply – page 15**). The power to the transmitter is in two banks. The first bank is terminals 40 and 43. The second bank is terminals 47 and 51.
2. If analog signals are slightly out of specification:
   a. Connect a digital voltmeter across Vref terminals (CN8) located in the lower right hand corner of the main circuit board. The reading should be the same as the Vref reading on the Hardware Page in ScanPC. “Vref” is approximately 5.0 Vdc.
   b. Perform an end-to-end calibration (refer to **Calibration** in software and/or firmware manuals).
3. Connect a digital voltmeter across the analog input terminals (e.g. 1-5 Vdc “analog input” and “Gnd”) or disconnect the input signal line and connect a digital current meter in sequence (4-20 mA).

   Input: The meter indication should correspond with process parameters measured by the transducer. For example, the pressure range 0-100 PSI, operating pressure is 50 PSI: current measured by meter should be 12 mA).

   Output: An Expansion board is required for analog outputs.

General Troubleshooting

Problem	*Possible Cause*	*Corrective Action*
No Display	Display goes blank when unused for 5 minutes.	Depress any of the buttons on the standard keypad for 1 second.
	If terminal communication is functioning, then the problem is the keypad, display, or connections from the main board to the keypad and display.	Check ribbon cable and connections to keypad and display and main board. Keypad and/or display need require replacement.
No Terminal Communications (Display Functioning)	Communications settings between Scanner and terminal are not the same.	Check communications settings on the terminal and the Scanner.
	Cable from enclosure door connector not properly connected to the main board.	Check terminal communication connector on main circuit board.

Transmitter Voltage

Check "Vtx" on the main circuit board terminals. Refer to Step No. 1 of **Analog Inputs and Outputs** (**page 101**) for a description.

Main Battery Voltage

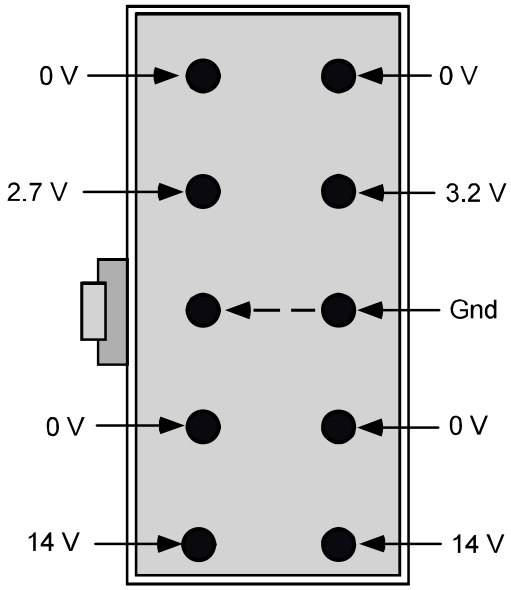
CAUTION

LOSS OF CONFIGURATION AND DATA MAY RESULT IF THE BATTERY CONNECTOR IS DISCONNECTED BEFORE PERFORMING THE BATTERY REPLACEMENT PROCEDURE.

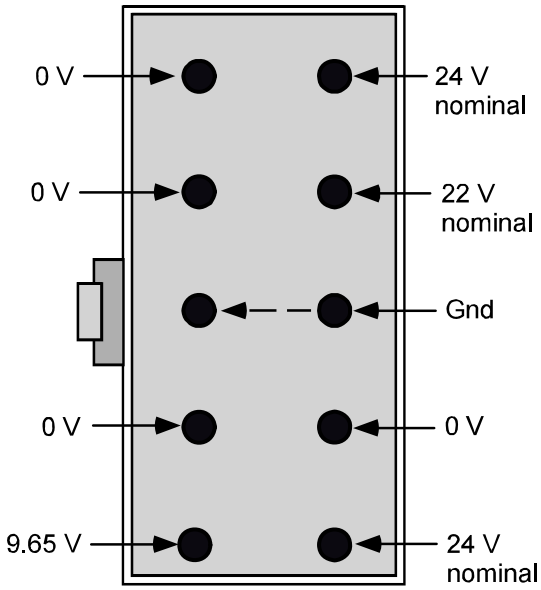
(REFER TO NGAS/NFLO SECTION 3.8 - **UTILITIES**).

Replace the battery and/or check the battery voltage. To check the battery voltage, unplug the battery power cable from the main circuit board and check voltages. Approximate readings are shown below:

1131 12 Volt Power Supply Readings (Unplugged)

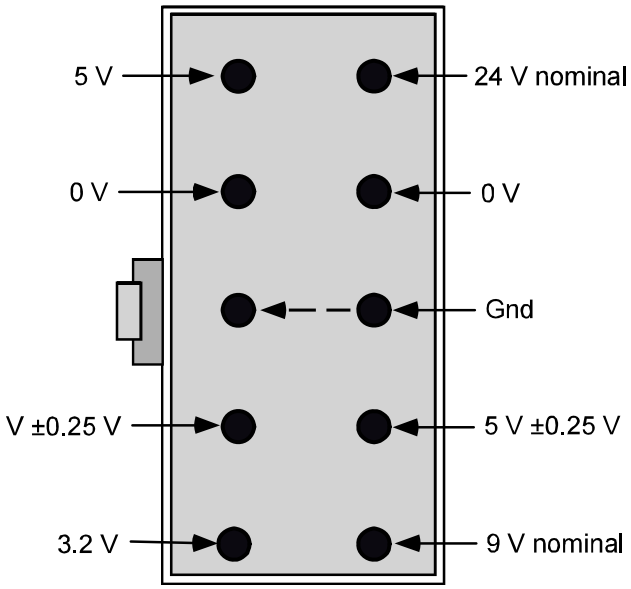


1131 24 Volt Power Supply Readings (Unplugged)



The following diagram shows the approximate readings obtained when the power supply is plugged into the main board:

1131 24 Volt Power Supply Readings (Plugged into Main Board)



The battery should be charged with a 15-28 Vdc supply at 750 mA maximum. The battery should be charged during storage and before installing in the flow computer. Voltage should be over 13 Vdc half an hour (30 minutes) after the power is removed. Replace battery if voltages are low to zero. Recharge questionable battery and recheck the connector voltages.

The supply voltage values are approximate (i.e., if the battery reads 12-14 Vdc - the battery is fine). The 24V power supply board should have a reading between 19 and 28 Vdc.

CN12 test points are shown in the table below.

Caution: Circuit board can be damaged if pins are shorted

Volts	Pin	Pin	Volts
5	Reset #	Int1	5
18.7	Vaa	Vlcd+	5
12	Vpg	Vlcd-	-7.5
0	Vpp	Vlcdb	0.45
10	Vtx10	Vtc	2.4
7.9	Vdd	Vee	-7.5
5	Vcc	Vbb	5
	Gnd	Gnd	

NVRAM Lithium Battery Voltage

The NVRAM Lithium battery must register above 2.0 Vdc when using ScanWin 2.2.3 and higher, with Firmware 4.1.4 and above OR ScanPC with Firmware 2.x and 3.x.

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. A new battery is 3.6V. 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 intrinsic safe circuit.

Note that with lithium batteries, the voltage drops off dramatically so there is never much “low voltage” warning. The 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.

6: DPE+ Installation

DPE+ Installation

Replacing a DPE with a DPE+ Transducer

This section provides step-by-step instructions for replacing a Scanner 1131 DPE with a DPE+ transducer. If the Scanner is to be used in a Class I, Div. 1 intrinsically safe installation, the upgrade requires the installation of a barrier adapter.

New Scanner firmware is also required to support communications with the DPE+ transducer. See the table on page 22 for Scanner firmware versions that support the DPE+ transducer.

WARNING

Explosion Hazard. Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

CAUTION

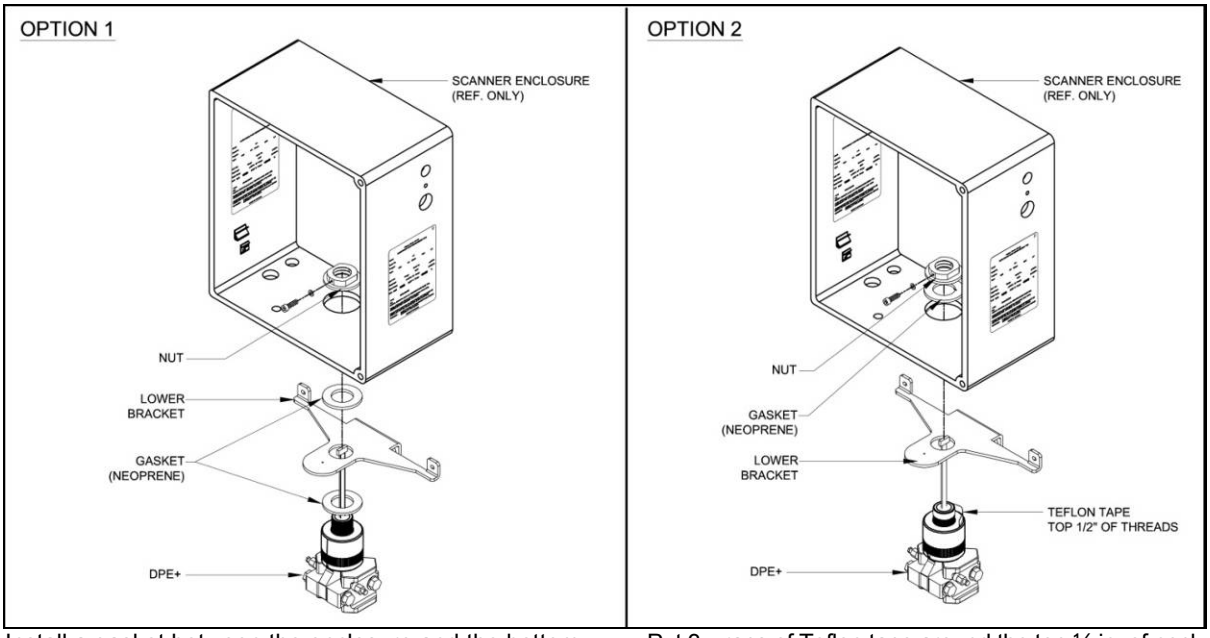
Static electricity can damage the DPE+ transducer. Use proper anti-static techniques to establish an earth ground (such as wearing anti-static wrist strap or touching metal) prior to removing the DPE+ from the anti-static bag.

1. Power down the Scanner.
2. Remove the tubing or manifold from the DPE.
3. Attach a static ground strap to your wrist and a Scanner ground.
4. Remove the ground screw from the DPE nut inside the enclosure.
5. Loosen the DPE nut on the outside of the enclosure.
6. Remove the DPE nut inside the enclosure using a 1 11/16-in. or adjustable wrench. It may be necessary to place a wrench on the DPE neck or body for leverage.
7. Unplug the DPE cable from the Scanner board.
8. Remove the DPE from the enclosure.
9. Examine the gaskets and replace as necessary to maintain a weatherproof enclosure. Two gaskets are supplied with each DPE+.

Gasket Options

For metal enclosures, the gasket is installed between the DPE+ and the enclosure.

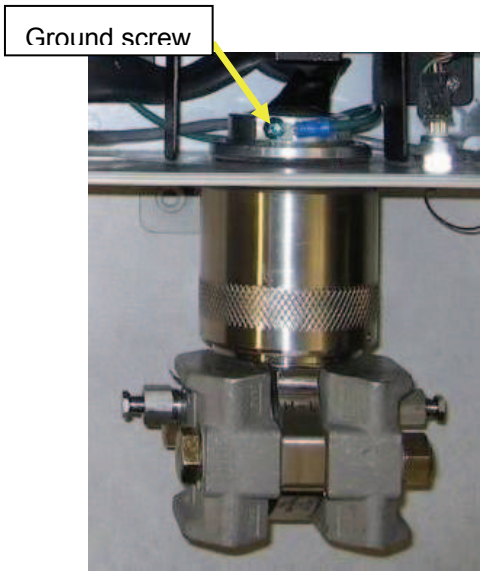
For fiber-reinforced plastic (FRP) enclosures, see options shown below.



Install a gasket between the enclosure and the bottom bracket, and another gasket between the bottom bracket and the DPE+ adapter.

Put 3 wraps of Teflon tape around the top ½ in. of neck threads of the DPE+ adapter. Install the gasket between the inside of the enclosure and the DPE nut.

10. Insert the top of the DPE+ transducer through the opening in the Scanner enclosure and secure, using the DPE nut from inside the enclosure. Make sure the ground screw is facing the front of the Scanner. The external nut from the original DPE installation is no longer needed and may be discarded.
11. Reconnect the ground wire to the internal DPE nut.



Proper positioning of the DPE+ transducer

12. With the Scanner power turned off, connect the ribbon cable from the DPE+ transducer to the Scanner. If the transducer is being installed while flashing new firmware to the Scanner and the Scanner power is on, wait until the Scanner is powered down to connect the DPE+ ribbon cable to the Scanner.
13. Reconnect the tubing or manifold to the DPE+ transducer.

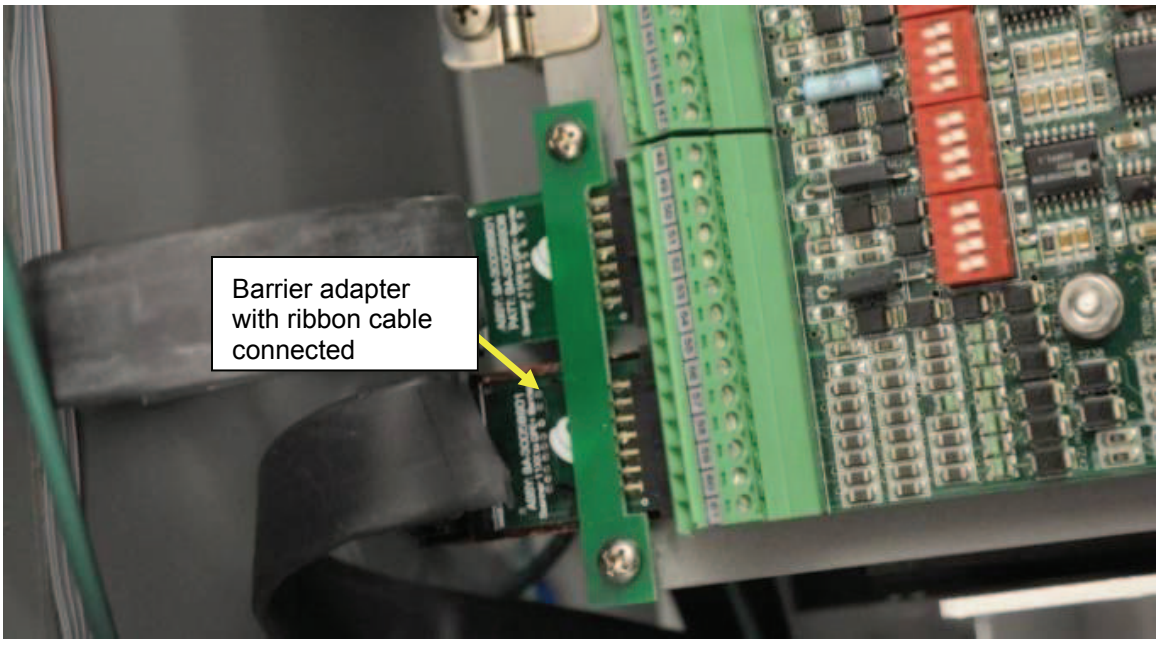
Installing the Barrier Adapter (for Class I, Div. 1 installations only)

WARNING

For Class I, Division 1 installations, an intrinsically safe barrier adapter must be installed between the Scanner and the DPE+ transducer. Barrier adapter Part No. 9A-30058901 is suitable for such installations.

To install the barrier adapter, follow the steps below.

1. Ensure power to the Scanner is turned off.
2. Remove the barrier adapter from the packaging.
3. Locate the DPE connector in the bottom right corner of the main board. The “DPE” label on the black decal on the extrusion that covers the main board inside the enclosure shows the correct positioning.
4. Plug the female end of the barrier adapter into the connector on the Scanner main board.
5. Plug the ribbon cable from the DPE+ transducer into the connector near the top of the barrier adapter.



Barrier adapter connection

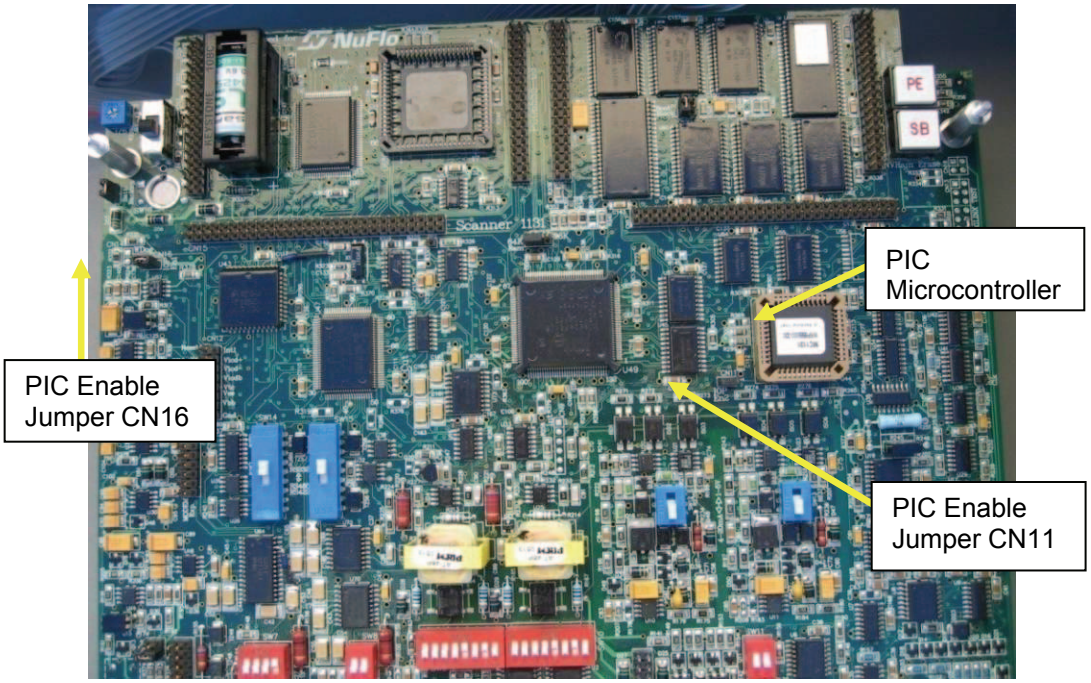
Installing the Microcontroller

CAUTION

The Scanner 1131 PIC microcontroller must be upgraded to Revision 3.5 or higher for use with the Barton DPE+ transducer.

If two transducers are in use, both must be upgraded to DPE+. The microcontroller will operate properly only when both DPEs are the same model (both DPEs or both DPE+).

1. Power down the Scanner by moving the slider switch SW18 to the OFF position. (SW18 is located at top left-hand corner of the main board next to the ½ AA lithium battery.)
2. Remove the two PIC enable jumpers from the main board, as shown on the next page.
   - Jumper CN16 is located below the power switch.
   - Jumper CN11 is located near the PIC.
3. Carefully remove the PIC micro-controller using a special tool or a small screwdriver, taking precautions to avoid cracking the plastic holder around the PIC.
4. Reinstall new PIC.
5. Reinstall jumpers CN16 and CN11.
6. Restore power to the Scanner by moving the slider switch SW18 to the ON position.
7. Start ScanWin/ScanPC and reset the clock.



Microcontroller jumper locations

7:Principles of Operation

Central Processing Unit (CPU)

The Scanner 1131 uses a 32-bit, 16 MHz, Intel™ 386EX microprocessor that has a demultiplexed 16-bit data bus and 26-bit external address bus, two asynchronous serial ports, two interrupt controllers, and a two-channel 8237 compatible DMA controller. Floating point mathematics are accommodated through software emulation, or optionally by an Intel™ 387SX math coprocessor, allowing computations to be completed several times faster that software emulation. Clock control, as well as idle and power-down modes allow the CPU to minimize system power consumption.

Clocks

The **CPU clock** provides 16 MHz to run the microprocessor. In power-save mode, the CPU clock is automatically shut down when the processor is inactive.

The **Real Time clock** is a combined clock and calendar with leap years. It provides all the timing functions to the flow computer, including the generation of the "heartbeat" interrupt 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 on the memory backup battery.

The Watchdog Timer

The **Watchdog Timer** prevents the microprocessor from becoming hung up in a loop (e.g., the processor is waiting for an input that never arrives). If a loop occurs, the Watchdog Timer resets the program to an initial starting point and normal operation continues.

Memory

There are three types of memory in the Scanner 1131: Flash program memory, Random Access Memory (RAM), and NonVolatile Random Access Memory (NVRAM). The program is stored in Flash memory, allowing firmware updates to be loaded into the flow computer via the serial port of any IBM™ compatible personal computer.

The Scanner 1131 has 1024 Kbytes of FLASH memory for code storage. This is provided by two (Intel) 4-megabit flash memories organized as 256K x 16 bits.

The flash devices also provide an upgrade path to 8-megabit devices, allowing the code space to be doubled, or allowing the elimination of one. The Flash memory is sectored into a 16-Kbyte protected 'boot' block, two 16-Kbyte 'parameter' blocks, a single 96-Kbyte 'main' block, and three 128-Kbyte 'main' blocks (the 8 megabit devices provide four additional 128-Kbyte 'main' blocks).

The protected 'boot' block is used to store the system's startup code, control firmware loading, as well as the field programmable gate array 'base' configuration, and is protected against accidental erasure by two pin jumper CN20. The jumper is installed to facilitate factory boot block programming, but is removed prior to shipping, eliminating the possibility that critical startup code will be damaged in the field.

The procedure for loading new firmware is detailed in **Flashing the Scanner (page 22)**.

RAM is used as a temporary storage during normal program execution, and is volatile. Any data held in RAM is lost during a power failure.

NVRAM is the system's long-term storage memory for large blocks of vital data (e.g., configuration data, logs, etc.) that are protected in case of a power failure. NVRAM power is backed up by an 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 its operation exactly where it stopped before the power failure occurred.

Field Programmable Gate Array

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. It is a RAM-based program that is loaded from Flash memory at system startup. This allows the logic to be modified and updated along with the application code, adding a great deal of flexibility to the system.

The FPGA generate all of the read and write information for the memory, I/O spaces, as well 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 pins for controlling the A/D system
- Analog outputs
- Transmitter supplies
- The Watchdog timer

Hardware Write Protection

The NVRAM is guarded against changes. NVRAM is only written when there is a configuration change, a power failure, or a system restart. These limitations prevent the loss of vital configuration and measurement data from becoming lost if there is an electrical transient or an uncontrolled program.

Power Management

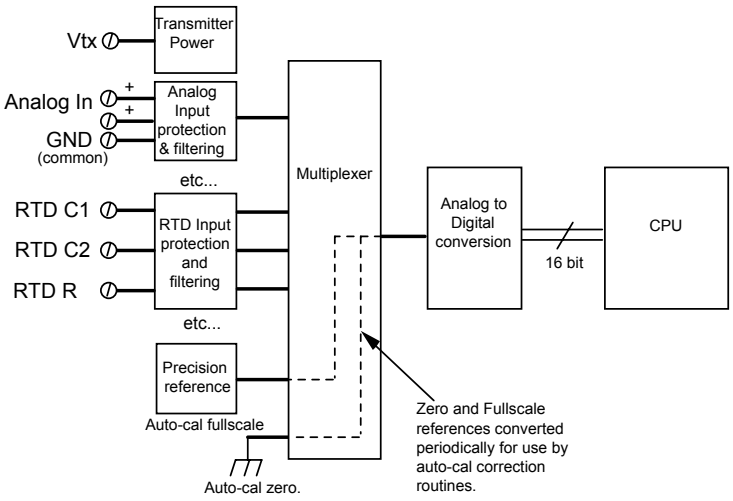
The Scanner 1131 has a software-selectable power-saver mode that conserves power without compromising accuracy or performance. When the power-saver mode is on, the CPU is inactive. The Real Time clock provides a "heartbeat interrupt" signal that turns the CPU "on" every 1/32 of second. During this momentary "on" period, the CPU performs any pending tasks. If no tasks are pending, the CPU shuts itself "off".

The power-saver mode can also cycle input (end) devices and RTD's. When analog readings are required, power to the particular end device is turned "on" and allowed to stabilize. (Stabilization time is selectable. Refer to Section 3.5 - System Configuration.)

Analog Inputs

Each analog input circuit is designed to read voltages from zero to 5 Vdc. Input devices having 1-5 V outputs are connected to analog inputs scaled 0-100% by software. If 4-20 mA devices are used, optional precision load resistors can be installed at the factory. 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. The sampling interval is software controlled (reference NGas/NFlo Section 3.3.1.1.1 - **Timing Page**).

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 leakages, and other errors. Further corrections, determined by 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.



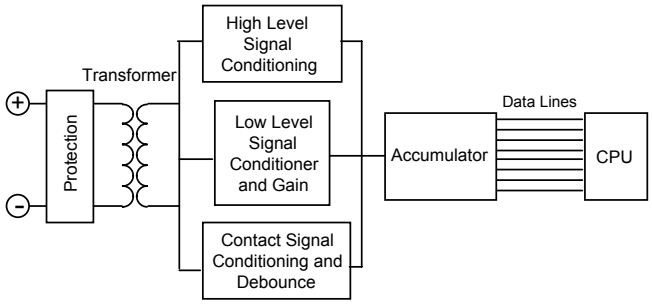
RTD Inputs

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

Pulse Inputs

The Scanner 1131 optional pulse inputs are designed to interface with a wide variety of devices including variable-reluctance magnetic pickup coils, signals from turbine preamplifiers (both voltage and current output types), and simple contact closures. DIP switches select the type of signal for each pulse input.

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



Barton DPE+ Multi-Variable Transducer

The Barton® DPE+ Multi-Variable Transducer provides both static pressure (SP) and differential pressure (DP) measurements in a variety of pressure ranges. One or two sensors can be connected to the Scanner 1131.

Performance specifications include:

- Accuracy: +/- 0.05% of full scale
- Long-term drift: +/- 0.05% of URL per year over a 5-year period.
- A “draft” range sensor, measuring 0 to 30-in. water column and 0 to 100-psi static pressure
- Static pressure ranges up to 5300 PSI

Hazardous area certifications include:

- CSA Intrinsically Safe Class I, Division 1, Groups C and D (Scanner 1131 is Class I, Division 1 approved only when the DPE+ transducer is installed with approved IS barrier)
- CSA Non-incendive Class I, Division 2, Groups A, B, C, D
- ANSI 12.27 Single Seal certified for pressure ranges up to and including 3000 psi

Scanner 1131s manufactured before 2008 may have a different transducer installed. The unit can be upgraded to use the DPE+ transducer for improved accuracy, or to replace a failed unit. For installation instructions, see **Chapter 6, DPE+ Installation, page 105**.

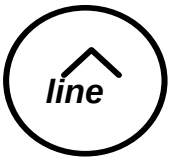
When the Scanner is configured with a DPE+ cell, the entire instrument is **verified** over the entire range of Temperature, Pressure and Differential Pressure to ensure that the linearity of the system meets published specifications. Local installation affects such as instrument positioning, tubing and site elevation require local calibration of both the differential pressure and the static pressure in order to obtain custody transfer quality accuracy. It is recommended that the DP and SP be **verified** upon installation and calibrated if required.

The DPE+ may also be **calibrated** at the factory. If this has been done, the only additional calibration procedure required for initial installation of a DPE+ cell is a local atmospheric zero calibration of the static pressure. However, a full static pressure calibration can be done by using a select number of calibration points.

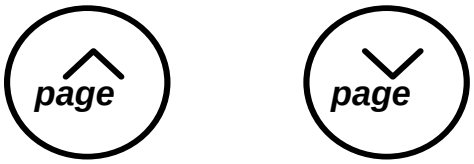
Front Panel

Standard Display and Keypad

The standard display is a 4-line by 20-character Liquid Crystal Display (LCD). Information is organized into “pages” of menu choices and data that are displayed on the local display screen or terminal. Normally, a blinking box cursor is visible on the display to indicate the active item. A special $^{A}_{L}$ cursor replaces the normal box cursor when active check alarms are present (refer to the NGas/NFlo **Alarm Page** section). The standard keypad is only used for viewing data.

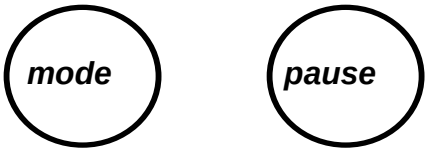


The ***line up*** and ***line down*** keys move the cursor up and down on the screen. Pages can be longer than the four lines visible on the standard display. The ***line up*** and ***line down*** keys are used to scroll through the information.



The ***page down*** key selects the item indicated by the cursor and expands it into a full page. The ***page up*** key "closes" the current page and causes it to collapse back into a single line from the previous page.

The ***detail*** key calls up the "detail page" of the selected line item. Each item has an associated detail page that contains help text and other information that is dependent on the nature of the item selected.



The ***mode*** key switches the display between menu mode and autoscroll mode. In autoscroll mode, the display steps through a user-defined list of items. Each item is held on the display for a user-configurable time (refer to the NGas/NFlo **Display/Keypad** section), and is then replaced by the next item. Pressing the ***pause*** key for one second freezes the display on the current item on the display. Pressing the ***pause*** key again resumes the autoscroll.

The following is a sample of an autoscroll screen:

```
Run 1 : Run 1  On
Absolute Press
-- No User Text --
492.00000 PSI
```

While in autoscroll mode, the following unit status screen is displayed once every loop through the user-defined list of items is completed:

```
Node= UnitName
Time= 09:00 ML
Date= July 4,2000
Battery= 12.6 Volts
```

The display will blank after five minutes of inactivity. To "wake-up" the display, press and hold any key for one second.

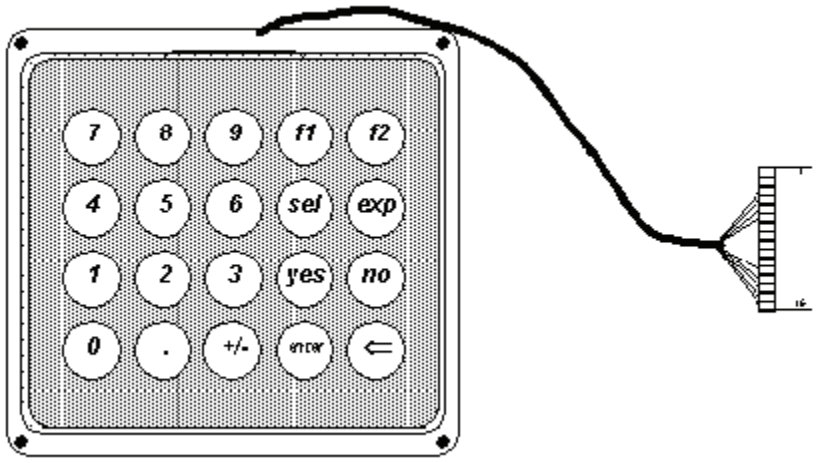
NFlo M4.2.0x firmware and higher:

Display units are now selectable for flowrun values in the local display Summary screen, even without an extended keypad. To select the units without an extended keypad, scroll down to the item by hitting the UNITS key repeatedly; then press the DETAIL key to save your choice.

Flowruns may now be turned on and off using the local display and standard keypad. To change a flowrun's running mode without using an extended keypad, go to the "Status" item in the flowrun's detail screen. Select the mode using the UNITS key and hit the DETAIL key to save your choice. Any changes will be logged in the user change log as the "local" user.

Extended Function Keypad

The **Extended Function** keypad contains all the necessary keys for the numerical configuration of the Scanner without a terminal, except alpha characters. The Node Name and flowrun names with letters must be configured from a PC. However, the Extended Function keypad cannot be used to download or upload data.



8: System Specifications

General Specifications

Environmental

Operating Temperature	-40°C to +60°C (-40°F to +140°F) - operating computer
	-30°C to +65°C (-22°F to +149°F) - non-back-lit alphanumeric displays
	-10°C to +50°C (14°F to +122°F) - back-lit alphanumeric displays
Storage Temperature	-40°C to +85°C (-40°F to +185°F) - non-back-lit alphanumeric displays
	-30°C to +65°C (-22°F to +149°F) - back-lit alphanumeric displays
	-
Relative Humidity	Maximum 90% non-condensing (standard display)
Electrical Classification	CSA certification - Intrinsically safe, Class I, Division 1, Groups C & D
Enclosure	CSA certified - Enclosure 3R (Weatherproof) General Purpose

Physical

Enclosure Material	Fiberglass reinforced plastic (FRP)		
Finish	Gray		
Size	420 mm (16.5”) H x 370 mm (14.6”) W x 211 mm (8.3”) D		
Mounting	Wall mount or a 2” pipe mount (carbon or stainless steel bracket)		
Components	Single main circuit board (CPU, memory, communications and I/O circuitry); local LCD display; local keypad (either standard or with optional extended function keypad); battery module w/solar panel or Div 2 DC power supply module (19-28 Vdc).		
Rack Mount Option	19” Rack mount configuration. General purpose: 19 - 28 Vdc power supply module. Standard E1A dimensions 3V height.		
Weight	Enclosure/Electronics	Net:	13 kg (29 lbs.)
	DPE+ Cell	Net:	3.8 kg (8.4 lbs.) each
	Battery (32Ah):	Net:	11 kg (25 lbs.)
	Solar Panel:		
	(5 Watt)	Net:	3 kg (6.5 lbs.)
	(10 Watt)	Net:	4 kg (8 lbs.)

	Bracket:		
	(Universal)	Net:	2.3 kg (5 lbs.)
	(Pipe Mt. End Cap)	Net:	1.5 kg (3.2 lbs.)
	(Wall Mount)	Net:	2.3 kg (5 lbs.)
	Shipping	Add	4.5 kg (10 lbs.)
Terminals	Depluggable, 45° 16-28 AWG		

Computer

CPU	Intel™ 386EX, 32-bit embedded processor, 16 MHz
Coprocessor	Intel™ 387SX math coprocessor (optional)
FLASH	1 Mb standard program memory
RAM	Switch selectable up to 160 Kbytes depending on firmware, static CMOS scratchpad memory
RAM/NVRAM	Up to 768 Kbytes (Total RAM + NVRAM), battery-backed static CMOS
Real Time Clock	Battery backed real-time clock/calendar, 1 second resolution
	Accuracy: ± 1 minute per month @ 25°C (+77°F)
	Stability: ± 3 ppm/°C from -10°C to +60°C (+15°F to +140°F)
	± 5 ppm/°C over full operating temperature
Monitors	Watchdog Timer
	Hardware write protection on NVRAM
NVRAM Battery	Single cell lithium, powers clock and NVRAM
	Provides one year of unpowered backup
	Replaceable in safe area

Communications

Quantity	4 Ports
Port 1	Accessible through a DB9 or round Fischer 8-pin connector or on the main board with small expansion boards (e.g. Remote Console Serial Port or Comm. Accessory Board). [1]
	Type: RS-232C, Bi-directional
	Signals: Tx, Rx, DSR and Gnd
	Handshake: Software only (XON/XOFF)
	Typical Usage: Console device (IBM PC-compatible or handheld terminal), Gas Chromatograph (GC)

[1] If the optional serial ports (3 and 4) are **not** installed, Port 1 is multiplexed and automatically switches between the console connector (with DSR input) and the shared port. The shared port will accommodate a 3-wire serial RS232 device. The shared terminals for Port 1 are #8 (Tx), #9 (Rx) and #10 (Gnd).

Port 2 (A02)	Located on main board (terminal strip connections 1-7)	
	Type:	RS-232C, (optional RS-422, or RS-485)
	Signals:	Rx, Tx, RLSD (DCD), RTS, CTS, DTR, and Gnd
	Handshake:	Hardware or Software
	Typical Usage:	Modem or other serial device (user-selectable), Network port Second console port, or GC
Port 3 (A03)	Located on main board (terminal strip connections 8-13)	
	Type:	RS-232C
	Signals:	RX, TX, RTS, CTS, RLSD and GND
	Handshake:	Hardware or Software
	Typical Usage:	Modem or other serial device (user-selectable), Network port Second console port, or GC
Port 4 (A04)	Located on main board (terminal strip connections 14-19)	
	Type:	RS-232C (optional RS-422, or RS-485)
	Signals:	RX, TX, RTS, CTS, RLSD and GND
	Handshake:	Hardware or Software
	Typical Usage:	Modem or other serial device (user-selectable), Network port Second console port, or GC
Baud Rate	Selectable from 75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, (*14,400, 19,200 up to 38,400 - limited number of ports*)	
Parity	Selectable from odd, even, none	
Stop Bits	Selectable, 1 or 2	
Protection	All inputs and outputs are protected against ±40 V steady state over-voltage, plus 500 W surge for 1 msec.	

Communications Expansion Boards

(See chapter **3: Expansion Boards** for further expansion board specifications)

Remote Console Board (CN2 Terminals)

Parallel console port enables the console communications port to be wired to another location. Typically, this is used with a Remote Calibration Unit (RCU).

Comm. Accessory Board (CN3 Terminal)

Provides the same serial communication terminals as the remote console port, and in addition provides:

DTR Terminals:

Provides +7 Vdc for the operation of a line-powered modem.

Vtx Terminal:

Provides uninterrupted power for accessories, unlike the standard Vtx terminal found on the Scanner main terminal strip, this Vtx terminal is not turned on/off in the power save mode. With battery modules, 15 or 30 Ah, this voltage is maintained at 10 Vdc ± 1 V.

Ethernet-Bluetooth Board (CN10 Terminal)

Adds Ethernet and Bluetooth interfaces to the Scanner 1131. Ethernet communications allows users to collect and store Scanner history records to SCM format and upload them at Ethernet speed from anywhere on the Local Area Network. Bluetooth communications provides wireless data transfer up to 100 meters, eliminating the need for serial cable connections.

Operating Temperature:

-40°C to +85°C (-40°F to +185°F)

Hardware:

32-bit NET+ARM high-performance RISC processor (NS7520 @ 55 MHz)

4 MB Flash and 8 MB RAM on-board memory

On-board power supervisor

Network Interface:

Standard: IEEE 802.3

Physical Layer: 10/100Base-T

Data rate: 10/100 Mbps (auto-sensing); maximum 19.2 kbps

Mode: Full or half duplex (auto-sensing)

Connector: RJ-45

802.3af mid-span power pass-through

LEDs on module:

Link integrity

Network activity

Power Requirements:

3.3VDC @ 250 mA typical (825 mW)

I/O Expansion

Number of Connectors	2 (Refer to chapter **3: Expansion Boards**)

Display

Type	LCD	4 line x 20, alphanumeric (full ASCII character set)
	back-lit LCD	4 line x 20, alphanumeric, LED back-lit
Viewing Area	Alphanumeric:	70 mm x 21 mm (2.758". x .8274")
Character Format	Alphanumeric:	5 x 8 dots
Character Size	Alphanumeric:	2.95 x 5.55 mm
Operating Temperature	-30°C to +65°C (-22°F to +149°F) - non-back-lit alphanumeric displays	
	-10°C to +50°C (14°F to +122°F) - back-lit alphanumeric displays	
Storage Temperature	-40°C to +85°C (-40°F to +185°F) - non-back-lit alphanumeric displays	
	-30°C to +65°C (-22°F to +149°F) - back-lit alphanumeric displays	

Local Keyboard

Keys	8 Keys: ***page up***, ***page down***, ***line up***, ***line down***, ***details***, ***units***, ***mode***, and ***pause***
	Keys allow viewing (but not altering) flow data. Keypad and display, located on the front of the enclosure (or on the door), are externally accessible.

Keypad (Extended Functions)

Keys	20 keys (refer to the **Extended Function Keypad** section)
	Keys are suitable for data entry without a terminal. Alpha characters cannot be entered. Local keypad is still functional. The Extended Function Keypad is located on the enclosure door below the local keypad.
	Also refer to chapter **4: Local Display Menu Path (NFlo & IGas 4.X)** for more details.

Battery Charger/Power Supply

The 12Vdc battery charger/power supply boards feature a temperature compensated lead acid battery charger circuit that can be powered from a solar panel or an external DC power supply.

12 Vdc Charger / Power Supply Board for Div. 1 Areas

When using this board, the Vtx Transmitter Supply switch (**SW11**) should be set to **10Vdc** – see **page 36**.

Board Part Number	9A-1131-0301C

Board Assembly Number	ASM-3655802	
Area Use	CSA Intrinsically Safe Class 1, Div. 1, as per sheet 3 of 11 (Document 9A-1131-11002) **- Drawing 3: Power Supply (Div. 1).** Also certified for Class I, Div. 2.	
Solar Panel	10 Watt (standard) Groups C and D	
	18 Watt (optional) Group D only	
Battery (standard)	12V/32Ah Nominal rechargeable, sealed, lead acid, c/w temperature compensated, charge controller and voltage regulation (standard). System backup depends on temperature, sample rate and battery capacity.	
Battery Charger	Type:	Temperature compensated two-step voltage controlled charger
	Input Voltage:	13 to 28 Vdc maximum
	Voltage Drop:	2.5 V maximum @500 mA (supply to battery)
	Current Limit:	750 mA nominal
	Charger Float Voltage:	Adjustable to 14.0 V ±10% (factory set to 14.0 V @ room temperature)
Scanner RTU Supply Output	Shutdown Battery	
	Voltage	8.5 to 9.5 Vdc
	Restart Battery Voltage	10.7 to 12.1 Vdc
Transmitter Supp. Output (Vtx)	9 - 11 Vdc @ 15 mA	
Environmental	Operating Temperature:	-40°C to +60°C
	Storage Temperature:	-55°C to +80°C
	Relative Humidity: 0-95% non-condensing	
Supervisory Signals	Input and battery voltages are reported to the main board for monitoring.	

12 Vdc Charger / Power Supply Board for Div. 2 Areas

A modem/radio supply option provides a high power current limited output that can be controlled by the system board. This optional switch allows the computer to control the power supplied to a separate radio/modem so that the average power consumption of the system can be minimized. The radio/modem would be typically powered up for a short period each hour or each day when communication with a host computer is expected. The switch is protected from short circuit and is only available for Div. 2 applications.

When using this board, the Vtx Transmitter Supply switch (**SW11**) should be set to **10 Vdc** – see **page 36**.

Board Part Number	9A-1131-0302C
Board Assembly Number	ASM3655803
Area Use	CSA Class 1, Div. 2, as per sheet 2 of 11 (Document 9A-1131-11022) **- Drawing 13: Power Supply (Div. 2 or Zone 2)**
Battery (standard)	12 V / 32 Ah Nominal rechargeable, sealed, lead acid, c/w temperature compensated, charge controller and voltage regulation (standard). System backup depends on temperature, sample rate and battery capacity. ***Note***: Larger battery requires external charge controller and a larger enclosure.

Solar Panel [2]	10 or 20 watt panel	
Battery Charger	Type:	Temperature compensated two-step voltage controlled charger
	Input Voltage:	13 to 28 Vdc maximum
	Voltage drop:	2.5 V maximum @ 500 mA (supply to battery)
	Current Limit:	750 mA nominal
	Charger Float Voltage:	Adjustable to 14.0 V ±10% (factory set to 14.0V @ room temperature)
Scanner RTU Supply Output	Shutdown Battery Voltage:	8.5 to 9.5 Vdc
	Restart Battery Voltage:	10.7 to 12.1 Vdc
Transmitter Supply	Output Voltage (Vtx):	9 - 11 Vdc @ 15 mA

[2] The larger 20-watt solar panel is recommended in areas where weather conditions may diminish the panel's power output. While this panel has an output of about 1.2 A, which exceeds the battery charger's current limit, the extra current output is useful in maintaining a full 750 mA current to the battery charger in adverse conditions (e.g. on cloudy days).

Radio/Modem Supply	Output Voltage:	Short circuit protected battery. Switched output with 0.8 Ω maximum series resistance.
	Max. Load Current:	2.0 A
	Low Voltage Cutoff:	Software controlled plus backup cutoff at 6.5 V
Environmental	Operating Temperature:	-40°C to +60°C
	Storage Temperature:	-55°C to +80°C
	Relative Humidity:	0-95% non-condensing
Supervisory Signals	Input and battery voltages are reported to the main board for monitoring.	

24 Vdc Power Supply for Div. 2 Areas

This power supply board is available to meet the higher peak power requirements for the Scanner 1131.

Depending on your installation configuration and requirements, the Vtx Transmitter Supply switch (**SW11**) may be set to **10 *or* 24 Vdc** – see **page 36**. Also, note the **Transmitter Supply Current Limits** listed below.

Board Part Number	9A-1131-0304C	
Board Assembly Number	ASM3655604	
Area Use	CSA, Class 1, Div. 2, as per sheet 2 of 11 (Document 9A-1131-11022) - **Drawing 13: Power Supply (Div. 2 or Zone 2)**	
Isolated Input Option	Input Voltage:	24 Vdc (19.2 to 28.8 Vdc)
	Isolation:	500 Vac for 1 minute
Transmitter Supply	Output:	24.0 V ± 2.4 V (isolated supply)
	Current Limit:	~240 mA (Switch SW11 in 24 Vdc mode) ~15 mA (Switch SW11 in 10 Vdc mode) – see **page 36**
Environmental	Operating Temperature:	-40°C to +60°C
	Storage Temperature:	-55°C to +80°C
	Relative Humidity:	0-95% non-condensing
Supervisory Signals:	Input and battery voltages are reported to the main board for monitoring.	

Electrical Inputs and Outputs Specifications

Analog Inputs

Number of Channels	Optional hardware: 1) Maximum Six 1 – 5 V, single-ended 2) Maximum Six 1 – 5 V or 4 – 20 mA, single-ended or differential, switch selectable 3) Maximum Twelve 4 – 20 mA, single-ended
Transmitter Options	1 - 5 Vdc 4 - 20 mA
Accuracy	± 0.030% of span max. error at +25°C (1 - 5 V) ± 0.045% of span max. error at +25°C (4 - 20 mA)
Average Temperature Effect	± 0.0025% of span/°C max. at +25°C (1 - 5 V) ± 0.0030% of span/°C max. at +25°C (4 - 20 mA)
Hysteresis	Not measurable
Impedance	> 100KΩ (1 - 5 V input), ~250 KΩ (4 - 20 mA)
Linearity	± 0.003% of full scale
A/D Resolution	16-Bit
Temperature Effect	Less than ± 0.25% of full-scale change per 100°C (180°F), including shunt resistors and all component errors, excluding transmitter / transducer error.
Filtering	Noise Rejection greater than 55 dB @ 60 Hz
Throughput	Up to 5 conversions / second
Under/Over Range	-25%, +5% of span (nominal)
Protection	Steady state: ± 20 V over-voltage Surge: 500 W for 1 msec.
Calibration	Autocalibration
Typical Usage	Differential pressure, pressure, temperature, specific gravity, heating value (mass), heating value (volume), %CO2, %N2, and % C1.
Allocation	User-selectable

Analog Outputs

Quantity	Two
Isolation	Optically isolated to 500 VAC, externally powered
Type	Switch selectable as wither 1 - 5 V or 4 - 20 mA
Accuracy	±0.1% of FS max. Error at 25°C (after factory calibration)
Temperature Effect	±1% of FS max. Error over temperature
Minimum Operating Voltage	9.5 Vdc (4 - 20 mA), 12.5 Vdc (1 - 5 V)
Maximum Voltage	±40 Vdc
Minimum Load (1 - 5 V Mode)	100 KΩ
D/A Resolution	12 bits
Calibration	Zero and full scale software calibration
Settling Time	< 100 msec. to 0.1% of full-scale for a 10% step change
Function	User assignable (flow rate, temperature, etc.)

Analog to Digital System

Resolution	16 bits
Linearity error	±0.015% typical
Throughput	All inputs converted in less than 0.1 seconds (high power mode only)

RTD Inputs

Quantity	Two (Standard)
Type	100 Ω 2 or 3-Wire, 100 Ω, platinum, 0.003850 or 0.003902 Ω/Ω/°C curves. Lead length compensation on 3-wire RTD's.
Range (Default)	-45°C to +120°C (-50°F to +250°F)
(User-entered)	up to +210°C (410°F), if lead compensation is less than 1 Ω
Accuracy	± 0.20°C at 25°C ambient including RTD linearization
Temperature Effect	± 0.0065°C measurement error / °C ambient change
Protection	Steady state: ± 40 V over-voltage
	Surge: 500 W for 1 msec
Allocation	Temperature only
Optional	RTD sensors in terminal housing or with armored wire 10', 20', 30' length, 10" probe with 1/2" NPT weather-resistant strain relief process connection.

Status Inputs, Status and Pulse Outputs

Quantity	6 assignable/selectable status inputs, status outputs, or pulse outputs
Function	User assignable for signaling alarms, controlling valves, and provides an interface to counters
Input Type	Voltage input or Contact Closure
Maximum Voltage	±40 Vdc
Status Input Threshold	The following values are the guaranteed limits that the input will be detected as having changed state. For example, with a 2 volt selection, the input will be detected as false (off) when the input is less than 0.5 V and on when it is more than 3.5 V. In typical operation, the trip transition points are within 0.5 volts of the nominal threshold.

Nominal Threshold	*Maximum Low Level Signal (Impedance)*	*Minimum High Level Signal (Impedance)*
2.0 V	0.5 V	3.5 V
7.0 V	5.0 V	9.0 V
10.0 V	8.0 V	12.0 V
Contact Closure	2 kΩ	200 Ω

Output Type	MOSFET, open drain
Output Surge Protection	300 W for 1 msec
Status/Pulse Output	Max. 100 mA on-state current Max. 0.5 Ω on-state resistance Max. 40 Vdc off-state voltage
Maximum Pulse Count Rate	16 Hz, 50% duty cycle

Pulse Inputs

Number of Channels	2 maximum
Signal Type	Switch selectable
Typical Usage	Volume, mass, and energy accumulation (from frequency pulse output device).
Allocation	User-selectable

Specifications:

Signal Type	*Maximum Low Level Signal*	*Minimum High Level Signal*	*Frequency Range*	*Input Impedance*	*Power Supplied by 1131*
2-wire Preamp Low Threshold (**page 44**)	1.6 mA	2.4 mA	0-8 kHz	620 Ω	Vtx
2-Wire Preamp High Threshold (**page 44**)	7.3 mA	12.1 mA	0-8 kHz	620 Ω	Vtx
3-Wire Preamp Low Threshold (**page 45**)	1.0 V	1.5 V	0-10 kHz	>10 kΩ	Vtx
3-Wire Preamp High Threshold (**page 45**)	4.5 V	7.5 V	0-10 kHz	>10 kΩ	Vtx
Magnetic Pickup Coil (**page 46**)		Minimum Signal Levels 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 @ 1 kHz	
Proximity Sensor (**page 46**)	1 mA	3 mA	0-5 kHz	N/A	
Contact Closure (**page 47**)	2 kΩ	200 kΩ	0-10 Hz	N/A	8 Vdc
Open Collector (**page 47**)	Off-state Leakage 50 µA	On-state Current 75 µA	Frequency Run 0-5 kHz		Off-state Voltage +8 Vdc

DPE+ Multi-Variable Transducer

<table>
<tr><td>Differential Pressure Accuracy</td><td colspan="5">Stability: Long-term drift is less than ±0.05% of upper range limit (URL) per year over a 5-year period
Accuracy (30 In. H2O)
±0.10% for spans ≥10% of the sensor URL
±(0.010) (URL÷SPAN) for spans <10% of the sensor URL
Accuracy (200 to 840 In. H2O)
±0.05% for spans ≥10% of the sensor URL
±(0.005) (URL÷SPAN) for spans <10% of the sensor URL</td></tr>
<tr><td rowspan="17">Effect on Differential Pressure for a 100-psi Change in Static Pressure</td><td>SP/SWP (PSIA)</td><td>DP (IN H2O)</td><td>Max. Overrange Pressure (PSIA)</td><td>Zero Shift</td><td>Span Shift</td></tr>
<tr><td>100</td><td>30</td><td>150</td><td>±0.05% of URL</td><td>±0.01% of reading</td></tr>
<tr><td>300</td><td>200</td><td rowspan="2">450</td><td>±0.007% of URL</td><td>±0.01% of reading</td></tr>
<tr><td>300</td><td>840</td><td>±0.002% of URL</td><td>±0.01% of reading</td></tr>
<tr><td>500</td><td>200</td><td>750</td><td>±0.010% of URL</td><td>±0.01% of reading</td></tr>
<tr><td>1500</td><td>200</td><td rowspan="4">2250</td><td>±0.010% of URL</td><td>±0.01% of reading</td></tr>
<tr><td>1500</td><td>300</td><td>±0.004% of URL</td><td>±0.01% of reading</td></tr>
<tr><td>1500</td><td>400</td><td>±0.004% of URL</td><td>±0.01% of reading</td></tr>
<tr><td>1500</td><td>840</td><td>±0.004% of URL</td><td>±0.01% of reading</td></tr>
<tr><td>3000</td><td>200</td><td rowspan="4">4500</td><td>±0.010% of URL</td><td>±0.01% of reading</td></tr>
<tr><td>300</td><td>300</td><td>±0.004% of URL</td><td>±0.01% of reading</td></tr>
<tr><td>3000</td><td>400</td><td>±0.004% of URL</td><td>±0.01% of reading</td></tr>
<tr><td>3000</td><td>840</td><td>±0.004% of URL</td><td>±0.01% of reading</td></tr>
<tr><td>5300</td><td>200</td><td rowspan="4">7420</td><td>±0.010% of URL</td><td>±0.01% of reading</td></tr>
<tr><td>5300</td><td>300</td><td>±0.004% of URL</td><td>±0.01% of readi</td></tr>
<tr><td>5300</td><td>400</td><td>±0.004% of URL</td><td>±0.01% of reading</td></tr>
<tr><td>5300</td><td>840</td><td>±0.004% of URL</td><td>±0.01% of reading</td></tr>
<tr><td>Static Pressure Accuracy</td><td colspan="5">Accuracy (500 psia)
±0.05% for spans ≥5% of the sensor URL
±(0.0025) (URL÷SPAN) for spans <5% of the sensor URL
Accuracy (300, 1500, 3000 and 5300 psia)
±0.05% for spans ≥10% of the sensor URL
±(0.0025) (URL÷SPAN) for spans <10% of the sensor URL</td></tr>
<tr><td>Temperature Performance</td><td colspan="5">±0.25% of full scale over full operating temperature range</td></tr>
</table>

DPE+ Pressure Limits and Bolt Specifications

SP/SWP (PSIA)	DP (IN H2O)	Max. Overrange Pressure (PSIA)	Standard Bolts	Limited NACE Bolts (not for offshore) [a]	Full NACE Bolts
100	30	150	B7 or 316 SS (with SS vent plug)	B7M (no vent plug)	B7M (with Hastelloy vent plug)
300	200	450	B7 or 316 SS (with SS vent plug)	B7M (no vent plug)	B7M (with Hastelloy vent plug)
300	840				
500	200	750	B7 or 316 SS (with SS vent plug)	B7M (no vent plug)	B7M (with Hastelloy vent plug)
1500	200	2250	B7 or 316 SS (with SS vent plug)	B7M (no vent plug)	B7M (with Hastelloy vent plug)
1500	300				
1500	400				
1500	840				
3000	200	4500	B7 or 17-4 SS (with SS vent plug)	Inconel (no vent plug)	Inconel (with Hastelloy vent plug)
3000	300				
3000	400				
3000	840				
5300	200	7420	B7 [b] (with SS vent plug)	Inconel [b] (no vent plug)	Inconel [b] (with Hastelloy vent plug)
5300	300				
5300	400				
5300	840				

[a] A regular stainless steel plug is substituted for the vent plug in limited NACE units.

[b] Not available with Canadian CRN or ANSI 12.27 Single Seal certification.

Order Code

Shaded selections indicate stocked items													
1131 Code Example: 1131	C	02	IM	00	11	M	10	26	33	33	83R	2C
1 **ENCLOSURE**													
Field Mount - (Nema 4 Fibreglass Reinforced Plastic) External Fischer	**C**												
OEM (Div II Non Incendive)	**G**												
Rack Mount (Div 2, non-incendive)	**R**												
Field Mount (Nema 4 Carbon Steel)	**S**												
2 **CERTIFICATION**													
None		**00**											
CSA ordinary locations		**01**											
CSA Intrinsically Safe, Class I, Div 1, Groups C & D, Typ4 [1131L]		**02**											
CSA non-incendive, Class I, Div 2, Groups A,B,C & D Typ4 [1131L]		**C2**											
CSA IS, Class I, Div 1, Groups C & D, Typ3R [1131C,1131S]		**32**											
CSA NI, Class I, Div 2, Groups A,B,C & D Typ3R		**06**											
CSA ordinary locations - MC Lock (1)		**11**											
CSA IS, Class I, Div 1, Grps C & D - MC Lock (1)		**33**											
CSA NI, Class I, Div 2, Groups A,B,C & D - MC Lock (1)		**16**											
(1) includes Configuration Lock Seal for Measurement Canada (MC)													
3 **TRANSDUCER**													
No Transducer			**00**										
Remote Mount DPE Transducer (Specify as separate line item)[1]			**RM**										
Integral Mounted DPE Transducer (Specify as a separate line item)[1]			**IM**										
Integral Mounted Pressure Transmitter, 100PSIG (1)			**P1**										
Integral Mounted Pressure Transmitter, 200PSIG (1)			**P2**										
Integral Mounted Pressure Transmitter, 300PSIG (1)			**P3**										
Integral Mounted Pressure Transmitter, 500PSIG (1)			**P5**										
Integral Mounted Pressure Transmitter, 1000PSIG (1)			**P6**										
Integral Mounted Pressure Transmitter, 1500PSI (sealed gauge) (1)			**P7**										
Integral Mounted Pressure Transmitter, 3000PSI (sealed gauge) (1)			**P8**										
Integral Mounted Pressure Transmitter, 5000PSI (sealed gauge) (1)			**P9**										
NOTE: 3a. Option codes IM or P1-P9 are not available for the 1131G or R													
[1] consult factory for availability													
4 **TRANSDUCER2**													
No Transducer				**00**									
Remote Mount DPE Transducer (Specify as separate line item)				**RM**									
Integral Mounted DPE+ Transducer (Specify as a separate line item)				**IM**									
Integral Mounted Pressure Transmitter, 100PSIG (1)				**P1**									
Integral Mounted Pressure Transmitter, 200PSIG (1)				**P2**									
Integral Mounted Pressure Transmitter, 300PSIG (1)				**P3**									
Integral Mounted Pressure Transmitter, 500PSIG (1)				**P5**									
Integral Mounted Pressure Transmitter, 1000PSIG (1)				**P6**									
Integral Mounted Pressure Transmitter, 1500PSI (sealed gauge) (1)				**P7**									
Integral Mounted Pressure Transmitter, 3000PSI (sealed gauge) (1)				**P8**									
Integral Mounted Pressure Transmitter, 5000PSI (sealed gauge) (1)				**P9**									
NOTE: 4a. Option codes IM or P1-P9 are not available for the 1131G or R													

5	**POWER SUPPLY**								
	Div1 or Div2, 12-28Vdc /6V Charge control [1131C, 1131S]	**11**							
	Div2, 12-28Vdc /12V Charge control [1131C, 1131S]	**12**							
	Div 2, 12-28 Vdc (applicable to all enclosure models)	**24**							
	NOTE:								
	5a. All charge controlled power supplies are non-isolated								
	5b. Options 11 and 12 are available only with the Field enclosures (Code S or C)								
6	**BATTERY**								
	None		**X**						
	12 VDC, 17 Ah (requires Power Supply '11' or '12')		**K**						
	12 VDC, 32 Ah (requires Power Supply '11' or '12')		**M**						
7	**SOLAR PANEL**								

Watts	Bracket	Cable	Approval	
None	None	None	n/a	**00**
10	Adj.	10'	Div 1	**10**
20	Adj.	10'	Div2	**20**
30	Adj.	10'	Div 2	**30**
50	Vertical	None	Div 2	**50**
80	Vertical	None	Div 2	**80**

NOTES: 7a. All brackets are for 2" pipe

8 **MAIN BOARD (INPUT OPTIONS)**

Analog Inputs	DPE / RTD Inputs	Freq. In / Analog out	Serial 232/485	Copro-cessor	
[6] 1-5V or 4-20 mA	2/2	2/2	2/2	N	**16**
Single or Differential	2/2	2/2	2/2	Y	**17**
[12] 1-5V Single Ended	2/2	2/2	2/2	Y	**26**
[12] 4-20mA Single Ende	2/2	2/2	2/2	Y	**27**

NOTE: 8a. Main board also includes six digital (status) inputs/outputs and 768K memory
8b. The single ended input configuration 12 is convertible to 4-20mA inputs with the addition of an auxiliary board, included with I/O option 27
8c. RS-485 ports are switch selectable to RS-232

9	**DISPLAY AND KEYPAD (4 line x 20 character LCD)**								
	Standard Display, Standard keypad						**01**		
	Backlit Display, Standard Keypad						**B1**		
	Standard Display, Extended Keypad						**11**		
	Backlit Display, Extended Keypad						**12**		

1131 Code Example: 1131	C	02	IM	00	11	M	10	26	33	33	83R	2C	R	00	S

10 EXPANSION BOARD 1

None	**00**
Remote Console Serial Port (ONLY in 1st slot or stacked on another expansion board)	**01**
Comm's Accessory Board (ONLY in 1st slot or stacked on another expansion board)	**02**

AS01 — Fits either expansion slot

Analog Outs	Status/Pulse Outs	
1	1	**11**
3	3	**33**

CD01 — Fits either expansion slot

Comm Port	Digital I/O	Config Lock Switch	
0	4	No	**41**

DI01 — Fits either expansion slot

Pulse Input- Turbine / PD Meters		Densitometer	
Standard	Phase Descrimination Level B Security	Input	
2	-	-	**60**
5	-	-	**61**
-	5	-	**65**

EB02: Ethernet only accessory board (Expansion slot 1 only) **E0**

EB02: Ethernet and Bluetooth accessory board (Expansion slot 1 only) **EB**

NOTE: 7a. For other options please consult factory

11 EXPANSION BOARD 2

Use the same order codes as previous field 10 (EXPANSION BOARD 1) above.
Except EB02 Board, which can not be used in expansion slot 2

12 PROGRAM

	ScanCom	Modbus	BSAP	PLC
NGas 2 ('85 AGA Gas Calcs)	**18R**	**19R**	**-**	
NGas 3 ('92 AGA Gas Calcs)	**38R**	**39R**	**L3R**	
NGas 4 ('92 AGA Gas Calcs	**note 12a**	**33R**	**-**	
IGas (ISO Gas Calcs)	**note 12a**	**59R**	**-**	
OPSat (Gas/Oil- Well Testing)	**N/A**	**N/A**	**-**	
NFlo 3 (Gas/Liquids- Hourly Data)	**88R**	**89R**	**-**	
NFlo 4 (Gas/Liquids- Hourly Data)	**note 12a**	**83R**	**L4R**	**P4R**

NOTES:

12a. Please use applicable Modbus program code, since all "4" series firmware versions are provided with ScanCom and Modbus communication protocols

12b. For other available programs please consult Barton document 1100-1002B

12c. Scan PLC (IEC61131 programming module) only available with NFlo 4 firmware, ScanCom / Modbus Protocol

ADD →

13 MOUNTING

None	[1131G]	**00**
2" Pipe Mount Universal (CS)	[1131C]	**2C**
2" Pipe Mount Universal (SS)	[1131C]	**2S**
Wall Mount Bracket	[1131C]	**WL**
2" Pipe Mount Universal (CS)	[1131S]	**2C**
2" Pipe Mount Universal (SS)	[1131S]	**2S**
Wall Mount Bracket	[1131S]	**WL**
Sliding Rail Kit for 19" Rack Mount Enclosure	[1131R]	**10**

14 RTD (Armored 3 wire 100 Ohm Platinum)

None	**A**
10 foot	**R**
30 foot	**S**
two 10 foot RTD Probes	**T**
two 30 foot RTD probes	**U**

NOTE: 14a. For non-standard lengths, please consult factory

1131 Code Example: 1131	C	02	IM	00	11	M	10	26	33	33	83R	2C	R	00	S

15 **NOTE: THIS FIELD [15] IS ONLY APPLICABLE TO MODELS 1131C & 1131S**
FOR ALL OTHER ENCLOSURE STYLES PLEASE SELECT CODE 00

COMMUNICATIONS INTERFACE

Order codes in this table are used to specify a "DCE Ready" Scanner only

Comm Device to Serial Port		Comm Device to Antenna		
None	0	None	0	**00**
None	0	Type N	N	**0N**
None	0	TNC	T	**0T**
None	0	SMA	S	**0S**
None	0	UHF	U	**0U**
DB25M Connector	5	None	0	**50**
DB25M Connector	5	Type N	N	**5N**
DB25M Connector	5	TNC	T	**5T**
DB25M Connector	5	SMA	S	**5S**
DB25M Connector	5	UHF	U	**5U**
DB9M Connector	9	None	0	**90**
DB9M Connector	9	Type N	N	**9N**
DB9M Connector	9	TNC	T	**9T**
DB9M Connector	9	SMA	S	**9S**
DB9M Connector	9	UHF	U	**9U**
Flying Leads	L	None	0	**L0**
Flying Leads	L	Type N	N	**LN**
Flying Leads	L	TNC	T	**LT**
Flying Leads	L	SMA	S	**LS**
Flying Leads	L	UHF	U	**LU**

Special, specify as a separate line item **SP**

DCE DEVICE
Consult Factory

NOTES:
14a. Includes pre-wired DCE communication cable, lightning surge protector, and internal co-ax service loop. For non-standard antenna / cabling options, please consult factory.
14b. For communication interfaces not listed, please consult factory.
14c. Please see list of standard options for antenna and external co-ax and specify as a separate option.

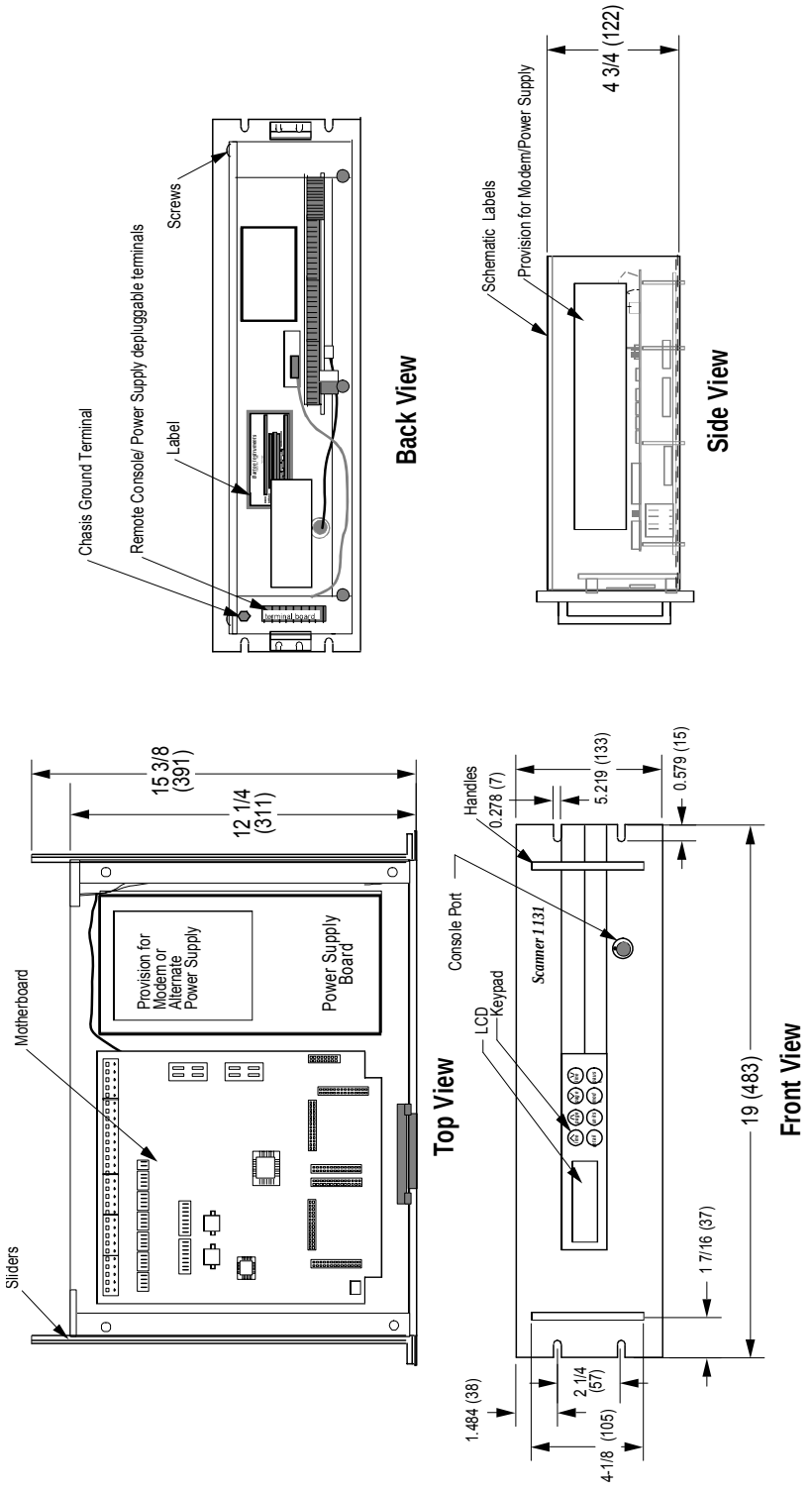
15 **SOFTWARE and DOCUMENTATION**

None	**X**
ScanWin Lite Software and Maintenance Manuals	**S**

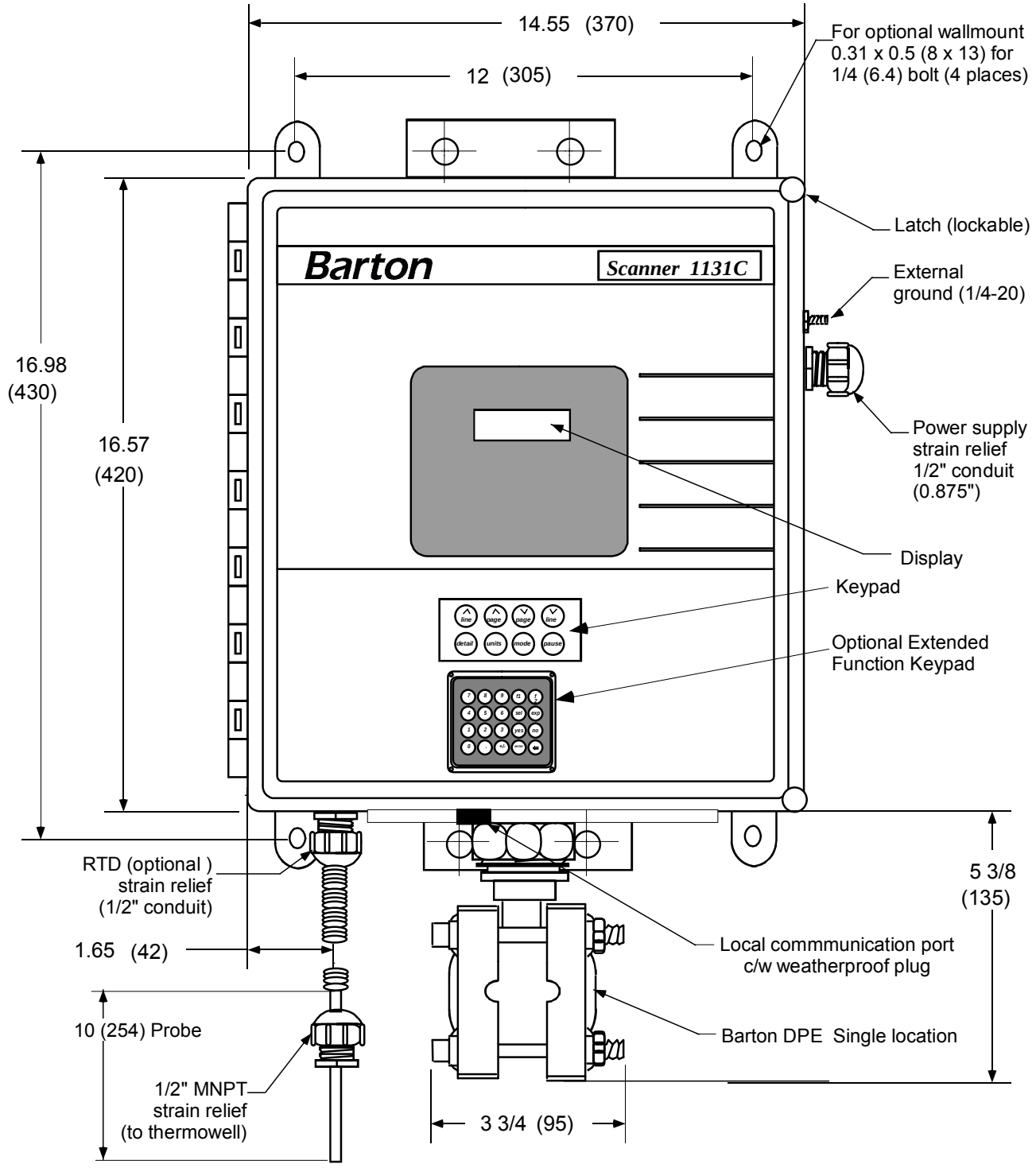
Outline Dimensions

Rack Mount

Note: All dimensions are shown in inches (millimeters). Tolerance ± 1/32" (1 mm), unless otherwise stated.
Top view is shown with the lid removed.



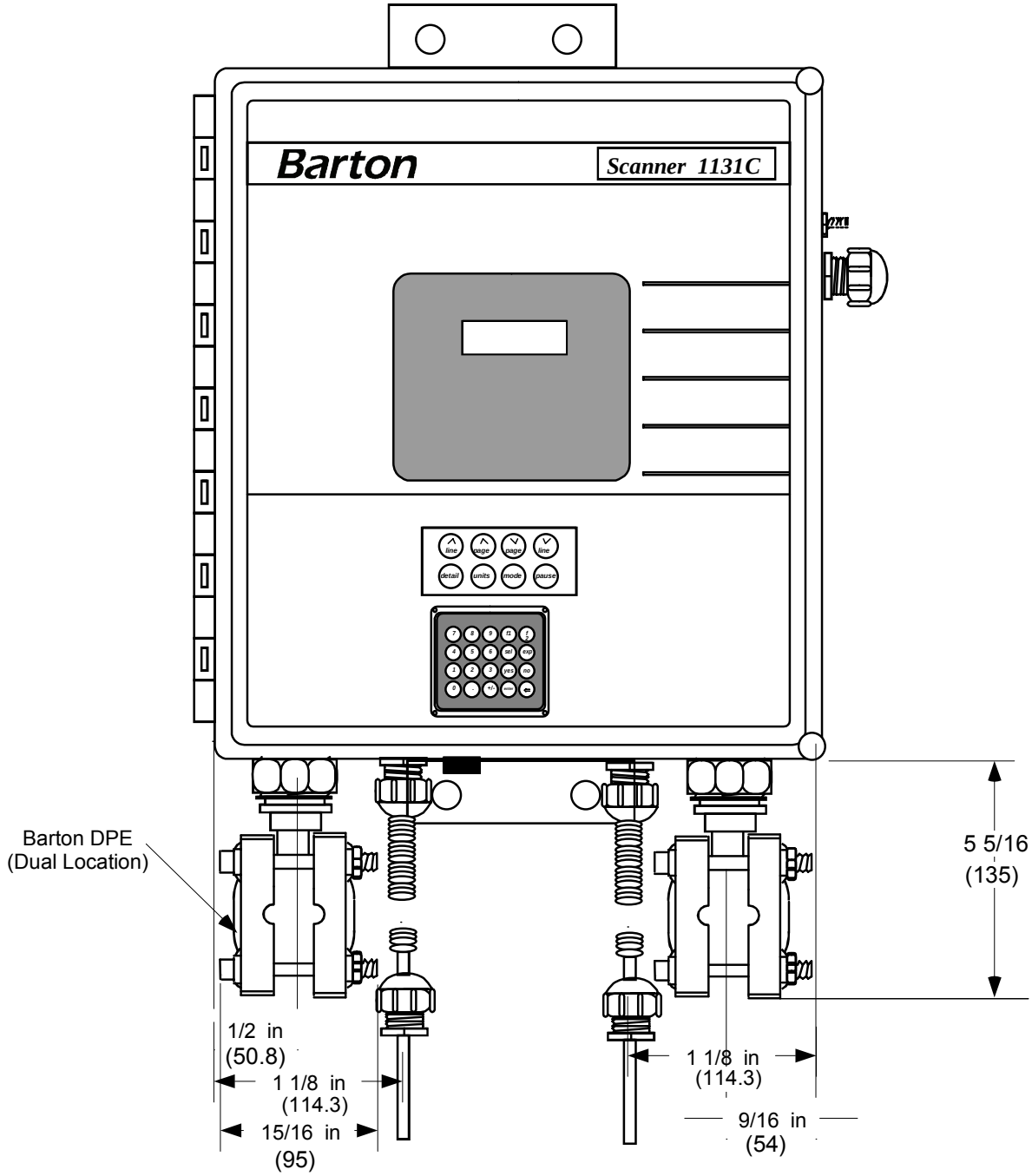
Scanner 1131C (Front View with Single DPE)



Notes: 1. All dimensions in inches. (Soft metric conversion) Tolerances: ± 1/8" (3.2mm)

2. Available mounting options: 2" U-bolt mount and wall mount

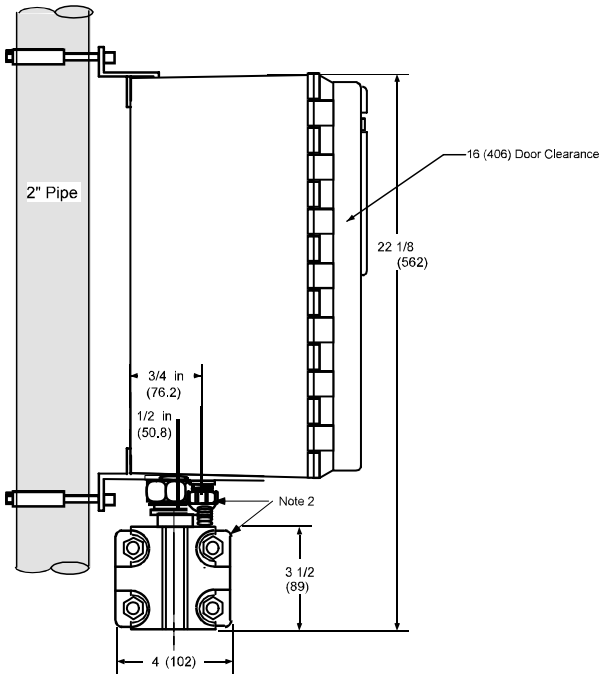
Scanner 1131C (Front View with Two DPE's)



2. Dual DPE Locations shown.

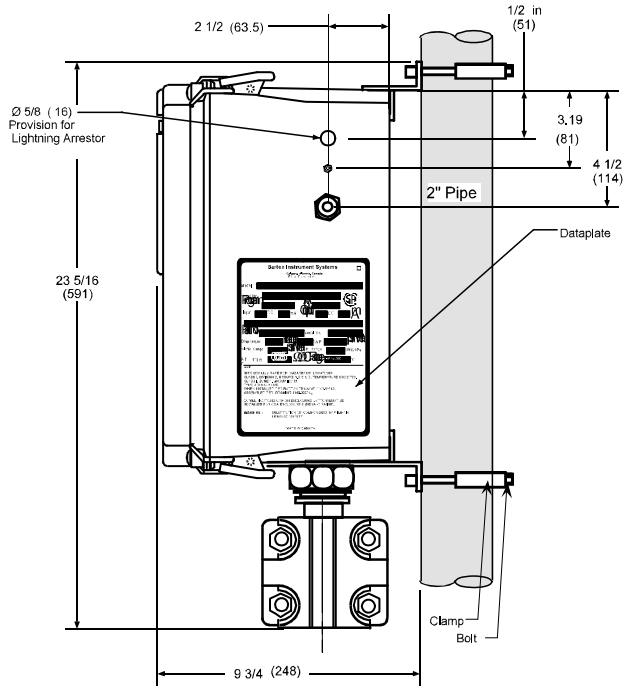
Notes: 1. All dimensions in inches. (Soft metric conversion) Tolerances: ± 1/8" (3.2mm)

Scanner 1131C (Side Views with Universal Mount)



2. Dual Location for RTD and DPE shown. For Singe location DPE is 2.25 (57.2) and RTD 2 (50.8)

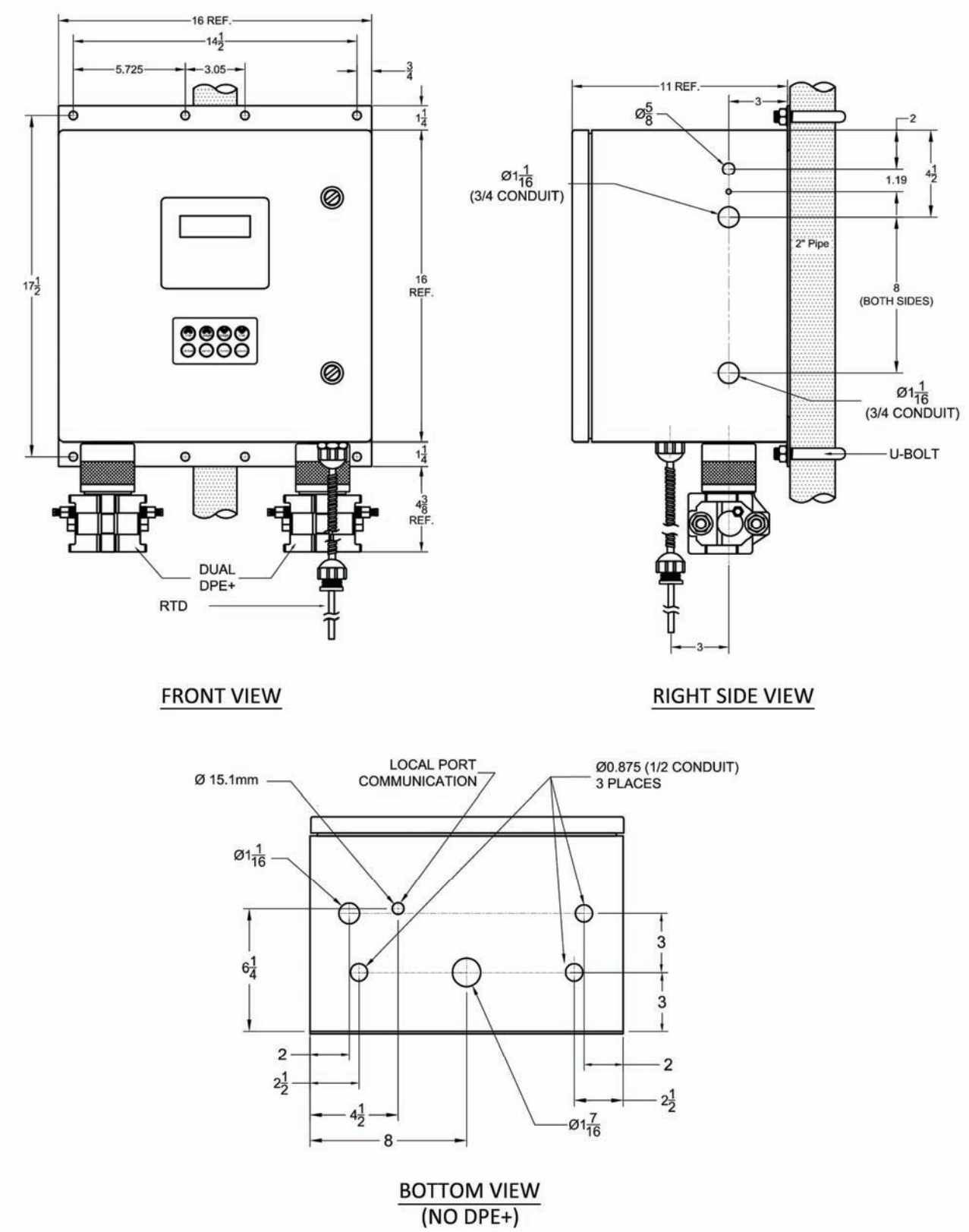
Notes: 1. All dimensions in inches fraction ± 1/32", 0.XX ± 0.01", 0.XXX ± 0.005"



2. DPE mounting standard 2-1/8 spacing 1/4" NPT process connections.

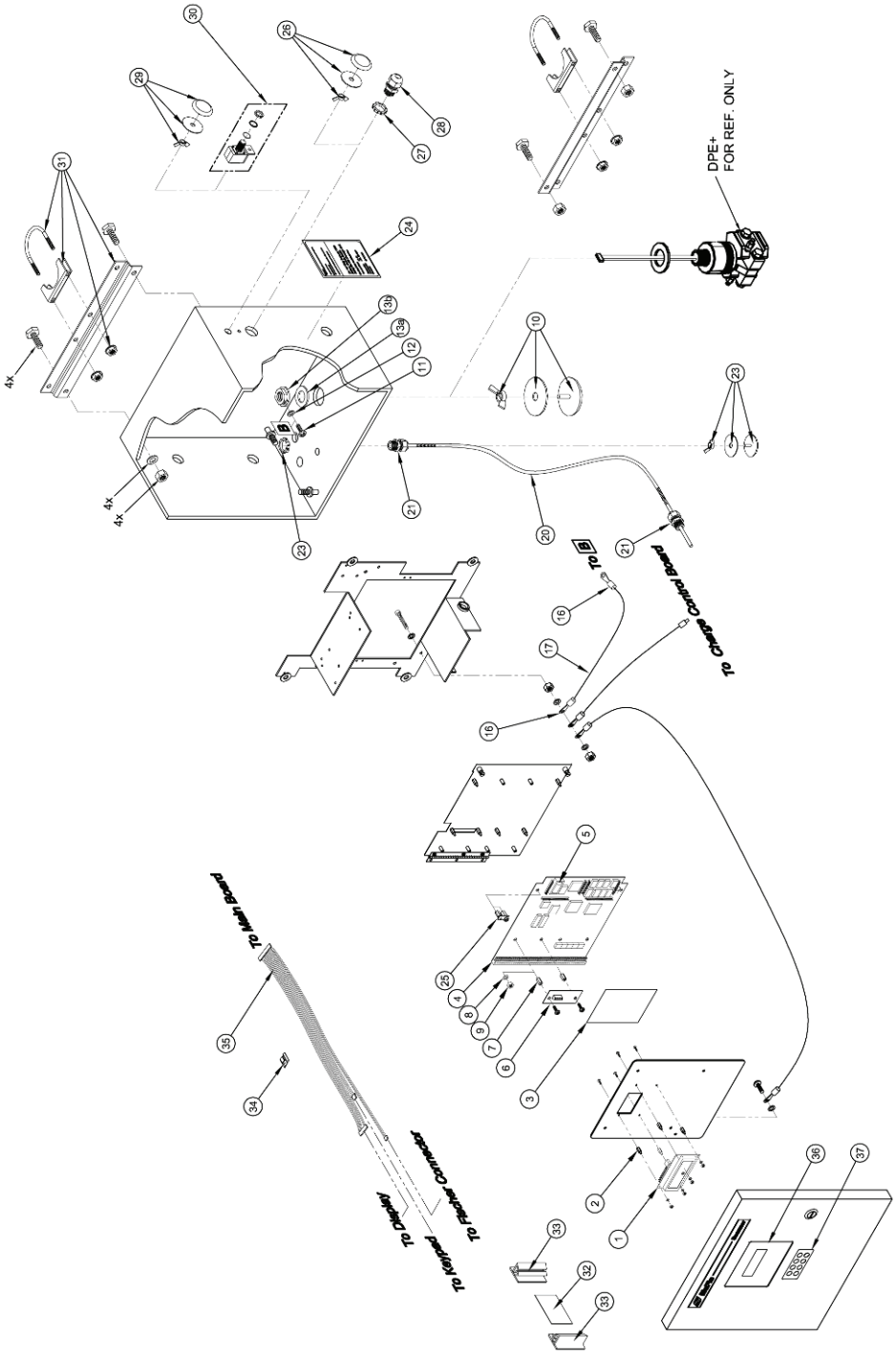
Notes: 1. All dimensions in inches fraction ± 1/32", 0.XX ± 0.01", 0.XXX ± 0.005"

Scanner 1131S



9: Parts Lists and Drawings

Standard Enclosure (1131S)



Display & Keypad

Item	Description	Part Number	Qty			
			01	02	11	12
1	Display, 4 X 20					
	Non Backlit	9A-1131-0402C	1		1	
	Backlit	9A-1131-0401C		1		1
2	Stand-off					
	MxF 2-56 x 3/8" Lg, Al - Non Backlit	9A-0152-9011T	4		4	
	MxF 2-56 x 1/4" Lg, Al - Backlit	9A-0152-1147T		4		4

Input Options

Item	Description	Part Number	Qty				
			00	D5	16	17	26
3	Decal						
	2DPE, Sensors - Scanner 1131	9A-1131-1019G	1	1	1	1	
	2DPE, 12 Analog - Scanner 1131	9A-1131-1020G					1
4	Mainboard						
	1131 IO00 1RS232 1SW NOC M	9A-1131-0100000239	1				
	1131 IO14 2RS232 2SW C M	9A-1131-0114021239		1			
	1131 IO16 2RS232 2SW NOC XM	9A-1131-0116020739			1		
	1131 IO17 2RS232 2SW C XM	9A-1131-0116021739				1	
	1131 IO26 2RS232 2SW C XM	9A-1131-0126021739					1
5	Battery, Lithium, 3.6V, 1/2AA	9A-0130-9018T	included in item 78				

Expansion

Item	Description	Part Number	Qty							
			00	01	02	33	41	60	61	65
6	Expansion Board									
	RTI1, Remote console serial port	9A-0155-1018T		1						
	RTI2, Communications accessory	9A-0155-1019T			1					
	AS01, 3 ANO, 3 S/P O	9A-0071-1028T				1				
	CD01, 0C, 4D, No Lock, Fixed	9A-1130-9138C-41					1			
	DIO1, 2-D, LA, No PD	9A-1130-9109C-20						1		
	DIO1, 5-D, LA, No Security	9A-1130-9109C-50							1	
	DIO1, 5-D, LA, PD Security	9A-1130-9109C-52								1
7	Stand-off, F X F 6-32 X 3/4" - Al	9A-0152-9005T		2	2	2	2	2	2	2
8	Lockwasher, Internal Tooth - #6, SS	9A-0003-0070K	2							
9	Nut, Machine Screw 6-32 SS	9A-0500-0021J	2							

Transducer

Item	Description	Part Number	Qty			
			00	RM	IM	PT
10	Seal, Hole - 1-1/2" Grey	9A-0192-1031T	1**	1**	1***	1**
11	Screw, Ph Bd Hd 8-32 X 1/4 - Green Head	9A-0119-9004J			1	
12	Lockwasher, External Tooth - #8, SS	9A-0003-9004K			1	
13a	Gasket, DPE Mounting - Neoprene	9A-1140-1026R			1	
13b	Nut, Seal - Capsule Stem, Ground Screw	9A-1140-1023C			1	
*14	Lockwasher, Internal Tooth - #6, SS	9A-0003-0070K			1**	
*15	Screw, Pan Ph Hd, 6-32 X 1/4, SS	9A-0119-1013J			1**	
16	Terminal Crimp, Ring Tongue #8 (14-16Awg)	9A-0109-9014T			2	
17	Wire, Std. 4 AWG - Green	9A-0012-9002T-11			6"	
*18	Lockwasher & Gasket, NEMA 4 - 1/2"NPT	9A-1140-1028J				1***
*19	Washer, Flat, M20, SS	9A-CS08-595-137				1***

RTD

Item	Description	Part Number	Qty				
			00	11	13	21	23
20	RTD Probe - 100 Ohm PL 4 Wire						
	10' AC	9A-1100-1010C-10		1		2	
	30' AC	9A-1100-1010C-30			1		2
21	Strain Relief, 1/2" NPT	9A-0091-9000T		2	2	4	4
22	Lockwasher & Gasket, NEMA 4 - 1/2"NPT	9A-1140-1028J		1	1	2	2
23	Seal, Conduit Hole - 3/4"	9A-0192-1029T	1				

Approvals

Item	Description	Part Number	Qty						
			00	01	02	06	11	12	16
24	Label								
	Scanner 1130/31, with DPE	9A-1130-1173GA	1						
	Unit Identification - 1130 CSA GP	9A-1130-1172G		1			1		
	I.D. Scanner 1131 CSA IS DIV 1&2	9A-1131-1004G			1			1	
	Scanner 1130/1131 CSA, DIV 2	9A-1130-1149GA				1			1
25	MC Sealing Assy, 1131	9A-1131-1012B					1	1	1

Solar Panel

Item	Description	Part Number	Qty					
			00	10	20	30	50	80
26	Seal, Conduit Hole - 3/4"	9A-0192-1029T	1					
27	Lockwasher & Gasket, NEMA 4 - 1/2"NPT	9A-1140-1028J		1	1	1	1	1
28	Strain Relief, 1/2" NPT	9A-0091-9000T		1	1	1	1	1

Communications

Item	Description	Part Number	Qty	
			00	other Codes
29	Seal, Conduit Hole - 3/4"	9A-0192-1029T	1	
30	Arrestor, Surge, Polyphaser IS-B50LN-C2	9A-0107-9001T		1

Mounting

Item	Description	Part Number	Qty	
			01	04
31	Rail, Polemount, 16"	9A-CS08-604-153	1	1

Options

Item	Description	Part Number	Qty
32	Analog Input Board, 12, Scanner 1131	9A-1131-1005B-01	1
33	Board Mount Track, Adhesive, Single	9A-0062-9010T	6"
34	Clip, Cable Ø 3/8" Capacity, Nylon	9A-CS08-412-106	2
35	Ribbon Cable Assy., 1130 Field Mount Std.	9A-1130-9130B	1
36	Lens, Blank, Metal Enclosure	9A-1140-1216D	1
37	Keypad, Eight Key, Weatherproof	9A-0097-9009T	1

*: PART NOT SHOWN
**: PART REQUIRED FOR 1ST TRANSDUCER FIELD 9
***: PART REQUIRED FOR 2ND TRANSDUCER FIELD 10

DPE+ Multi-Variable Transducer

Description	Part Number
Microcontroller, PIC, version 3.5 (required for DPE upgrade of Scanner 1131)	9A-1131-0103T
Intrinsically Safe Barrier Adapter, for CSA-certified Class I, Div. 1, Groups C, D installations	9A-30058901

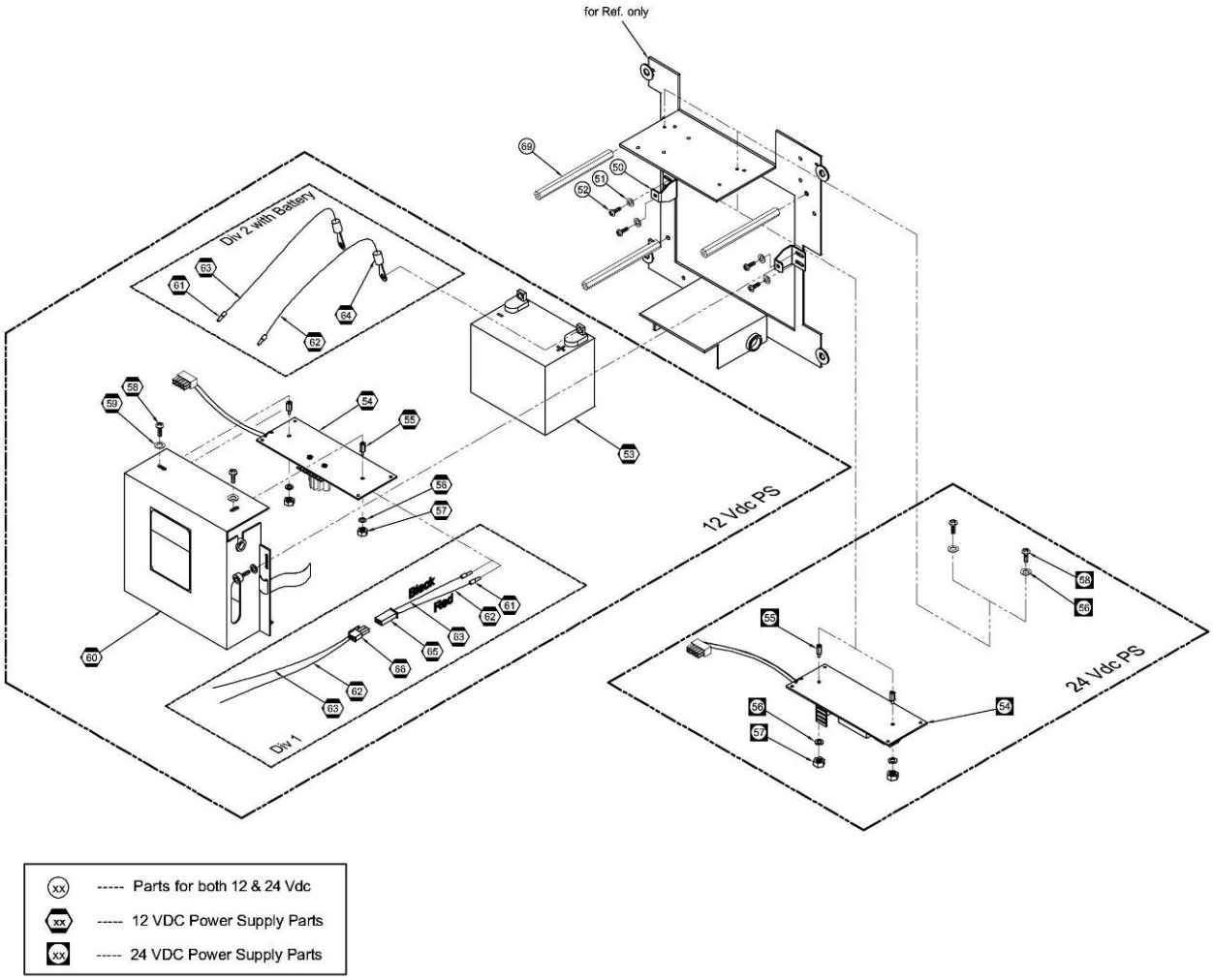
Range	Body/Bolt Material	Service	Part Number
100PSIA,30IN H20	316SS body / B7 bolts	Standard	9A-30058041
300PSIA,200IN H20	316SS body / B7 bolts	Standard	9A-30058042
300PSIA,840IN H20	316SS body / B7 bolts	Standard	9A-30058075
500PSIA,200IN H20	316SS body / B7 bolts	Standard	9A-30058076
1500PSIA,200IN H20	316SS body / B7 bolts	Standard	9A-30058043
1500PSIA,300IN H20	316SS body / B7 bolts	Standard	9A-30058077
1500PSIA,400IN H20	316SS body / B7 bolts	Standard	9A-30058078
1500PSIA,840IN H20	316SS body / B7 bolts	Standard	9A-30058079
3000PSIA,200IN H20	316SS body / B7 bolts	Standard	9A-30058044
3000PSIA,300IN H20	316SS body / B7 bolts	Standard	9A-30058080
3000PSIA,400IN H20	316SS body / B7 bolts	Standard	9A-30058081
3000PSIA,840IN H20	316SS body / B7 bolts	Standard	9A-30058082
5300PSIA,200IN H20	316SS body / B7 bolts	Standard	9A-30058045 [b]
5300PSIA,300IN H20	316SS body / B7 bolts	Standard	9A-30058083 [b]
5300PSIA,400IN H20	316SS body / B7 bolts	Standard	9A-30058084 [b]
5300PSIA,840IN H20	316SS body / B7 bolts	Standard	9A-30058085 [b]
100PSIA,30IN H20	316SS body / 316SS bolts	Standard	9A-30058097
300PSIA,200IN H20	316SS body / 316SS bolts	Standard	9A-30058098
300PSIA,840IN H20	316SS body / 316SS bolts	Standard	9A-30058099
500PSIA,200IN H20	316SS body / 316SS bolts	Standard	9A-30058100
1500PSIA,200IN H20	316SS body / 316SS bolts	Standard	9A-30058101
1500PSIA,300IN H20	316SS body / 316SS bolts	Standard	9A-30058102
1500PSIA,400IN H20	316SS body / 316SS bolts	Standard	9A-30058103
1500PSIA,840IN H20	316SS body / 316SS bolts	Standard	9A-30058104
3000PSIA,200IN H20	316SS body / 316SS bolts	Standard	9A-30058105 [b]
3000PSIA,300IN H20	316SS body / 316SS bolts	Standard	9A-30058106 [b]
3000PSIA,400IN H20	316SS body / 316SS bolts	Standard	9A-30058107 [b]
3000PSIA,840IN H20	316SS body / 316SS bolts	Standard	9A-30058108 [b]
100PSIA,30IN H20	B7M Bolts (not for offshore)	Limited NACE	9A-30058641
300PSIA,200IN H20	B7M Bolts (not for offshore)	Limited NACE	9A-30058642
300PSIA,840IN H20	B7M Bolts (not for offshore)	Limited NACE	9A-30058675
500PSIA,200IN H20	B7M Bolts (not for offshore)	Limited NACE	9A-30058676
1500PSIA,200IN H20	B7M Bolts (not for offshore)	Limited NACE	9A-30058643
1500PSIA,300IN H20	B7M Bolts (not for offshore)	Limited NACE	9A-30058677
1500PSIA,400IN H20	B7M Bolts (not for offshore)	Limited NACE	9A-30058678

Range	Body/Bolt Material	Service	Part Number
1500PSIA,840IN H20	B7M Bolts (not for offshore)	Limited NACE	9A-30058679
3000PSIA,200IN H20	Inconel Bolts (not for offshore)	Limited NACE	9A-30058644
3000PSIA,300IN H20	Inconel Bolts (not for offshore)	Limited NACE	9A-30058680
3000PSIA,400IN H20	Inconel Bolts (not for offshore)	Limited NACE	9A-30058681
3000PSIA,840IN H20	Inconel Bolts (not for offshore)	Limited NACE	9A-30058682
5300PSIA,200IN H20	Inconel Bolts (not for offshore)	Limited NACE	9A-30058645 [b]
5300PSIA,300IN H20	Inconel Bolts (not for offshore)	Limited NACE	9A-30058683 [b]
5300PSIA,400IN H20	Inconel Bolts (not for offshore)	Limited NACE	9A-30058684 [b]
5300PSIA,840IN H20	Inconel Bolts (not for offshore)	Limited NACE	9A-30058685 [b]
100PSIA,30IN H20	B7M Bolts / Hastelloy Vent Plug	Full NACE	9A-30058046
300PSIA,200IN H20	B7M Bolts / Hastelloy Vent Plug	Full NACE	9A-30058047
300PSIA,840IN H20	B7M Bolts / Hastelloy Vent Plug	Full NACE	9A-30058086
500PSIA,200IN H20	B7M Bolts / Hastelloy Vent Plug	Full NACE	9A-30058087
1500PSIA,200IN H20	B7M Bolts / Hastelloy Vent Plug	Full NACE	9A-30058048
1500PSIA,300IN H20	B7M Bolts / Hastelloy Vent Plug	Full NACE	9A-30058088
1500PSIA,400IN H20	B7M Bolts / Hastelloy Vent Plug	Full NACE	9A-30058089
1500PSIA,840IN H20	B7M Bolts / Hastelloy Vent Plug	Full NACE	9A-30058090
3000PSIA,200IN H20	Inconel Bolts / Hastelloy Vent Plug	Full NACE	9A-30058049
3000PSIA,300IN H20	Inconel Bolts / Hastelloy Vent Plug	Full NACE	9A-30058091
3000PSIA,400IN H20	Inconel Bolts / Hastelloy Vent Plug	Full NACE	9A-30058092
3000PSIA,840IN H20	Inconel Bolts / Hastelloy Vent Plug	Full NACE	9A-30058093
5300PSIA,200IN H20	Inconel Bolts / Hastelloy Vent Plug	Full NACE	9A-30058050 [b]
5300PSIA,300IN H20	Inconel Bolts / Hastelloy Vent Plug	Full NACE	9A-30058094 [b]
5300PSIA,400IN H20	Inconel Bolts / Hastelloy Vent Plug	Full NACE	9A-30058095 [b]
5300PSIA,840IN H20	Inconel Bolts / Hastelloy Vent Plug	Full NACE	9A-30058096 [b]

[a] A regular stainless steel plug is substituted for the vent plug in limited NACE units.

[b] Not available with Canadian CRN or ANSI 12.27 Single Seal certification.

Battery and DC Power Supply

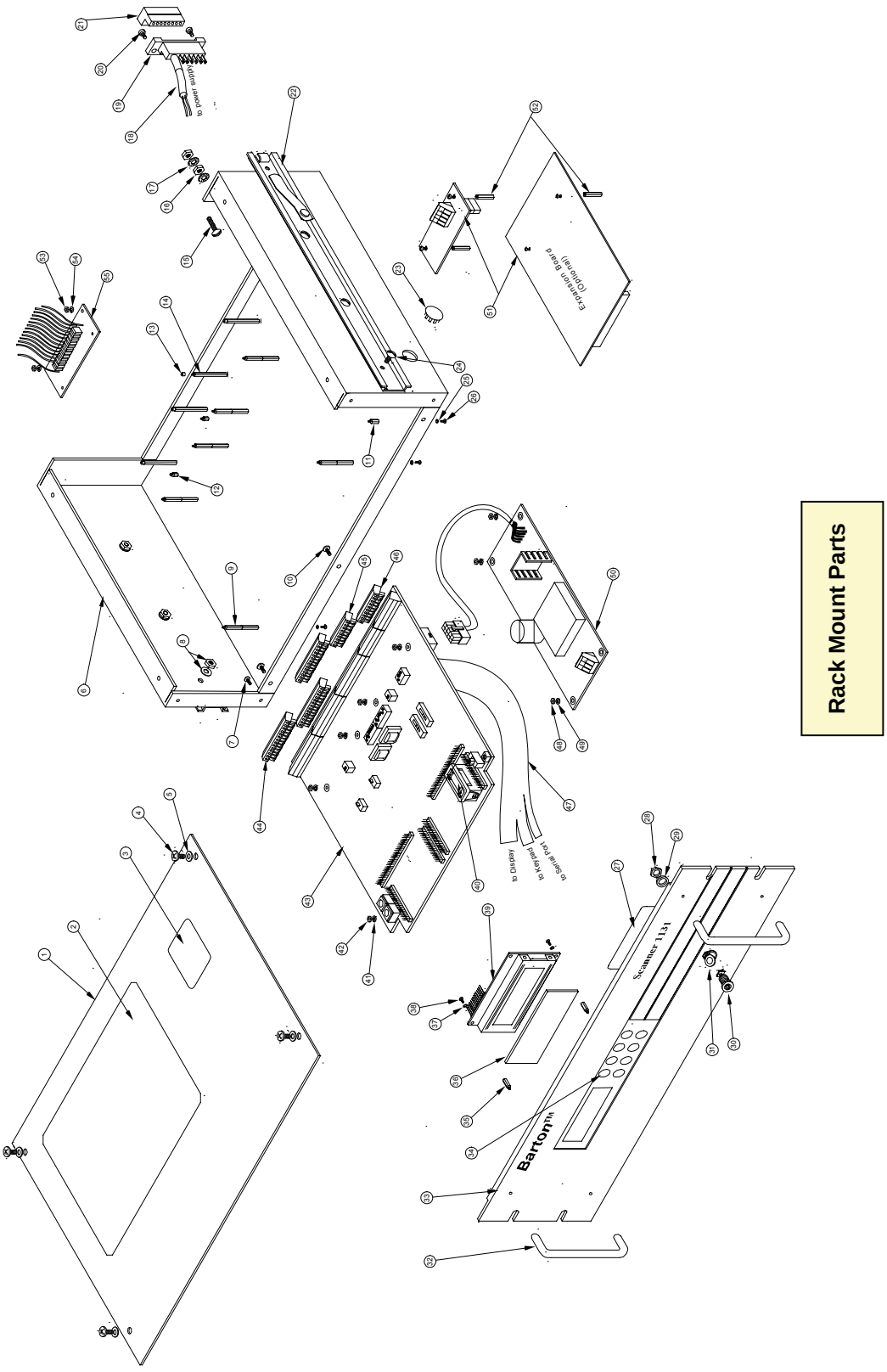


Item	Description	Part Number	Per Unit		
			12 VDC Div 1	12 VDC Div 2	24 VDC
50	Clip, Battery Bracket, 1131	9A-CS08-400-145	2	2	2
51	Lockwasher, Internal Tooth - #8, SS	9A-0003-0066K	4	4	4
52	Screw, Bd Ph Hd 8-32 x 3/8 18-8 SS	9A-0119-9001J	4	4	4
53	Battery, Lead Acid, 12V 32Ah	9A-0130-9014T	1	1	
54	Charge Control Board				
	Non-isolated, Div. 1, I.S. – 12 VDC Input	9A-1131-0301C	1		
	Non-isolated, Div. 2, I.S. – 12 VDC Input	9A-1131-0302C		1	
	Isolated – 24 VDC Input	9A-1131-0304C			1
55	Stand-off, M x F 6-32 x 3/8” – AI	9A-0152-9007T	2	2	2
56	Lockwasher, Internal Tooth, #6, SS	9A-0003-0070K	2	2	4
57	Nut, Machine Screw, 6-32, SS	9A-0500-0021J	2	2	2

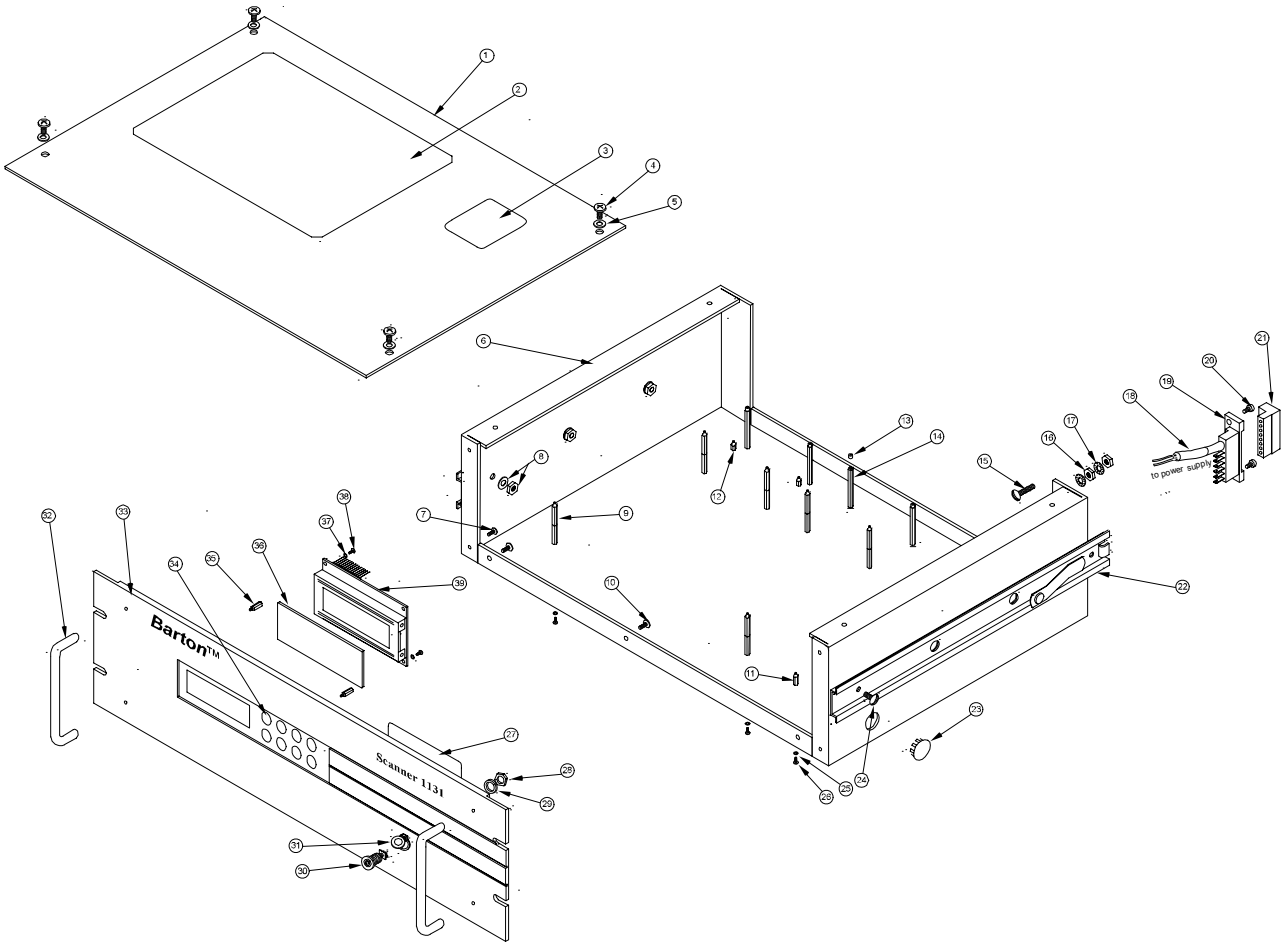
Item	Description	Part Number	Per Unit		
			12 VDC Div 1	12 VDC Div 2	24 VDC
58	Screw, Pan, Ph Hd, 6-32 x 1/4, SS	9A-0119-1013J	2	2	2
60	Battery Assembly, No Battery, No Board	9A-1130-9110B-03	1	1	
	Clip, Retainer-captive screw	9A-0062-1025T	2		
	Screw, Captive, 8-32x1/2, SST	9A-0002-1013T	2		
	Strap, Velcro, 50 cm	9A-0022-9001T-06	1		
	Grommet, Hole, 9/16” I.D., Vinyl	9A-0081-9001T	1		
	Bracket, 32 Ah Battery	9A-1130-9102C	1		
	Label, Battery Mounting	9A-1130-9114G	1		
	Washer, Flat, #8, 18-8, SS	9A-0003-0039K	2	2	
61	Wire Tip Ferrule, Blue H2.5/14	9A-1130-4666T	2	2	
62	Wire, Stranded 14 Awg – Red	9A-0012-9002V-09	18”	18”	
63	Wire, Stranded 14 Awg - Black	9A-0012-9002V-03	18”	18”	
64	Terminal, Ring-type – Size 16 Blue	9A-0109-9006T		2	
65	Plug Connector, Mini Two Contact	9A-0109-1304T	1		
66	Receptacle, Connector – Two Contact	9A-0109-1308T	1		
*67	Socket, Connector “F” – Bronze Tin Plate	9A-0109-1309T	2		
*68	F. Pin, Connector – Brass Gold Plated	9A-0109-1303T	2		
69	Stand-off, F x F, 1/4-20 x 8-32 x 5” lg. AI	9A-0152-9016T	3	3	3

*Part Not Shown

Rack Mount Enclosure



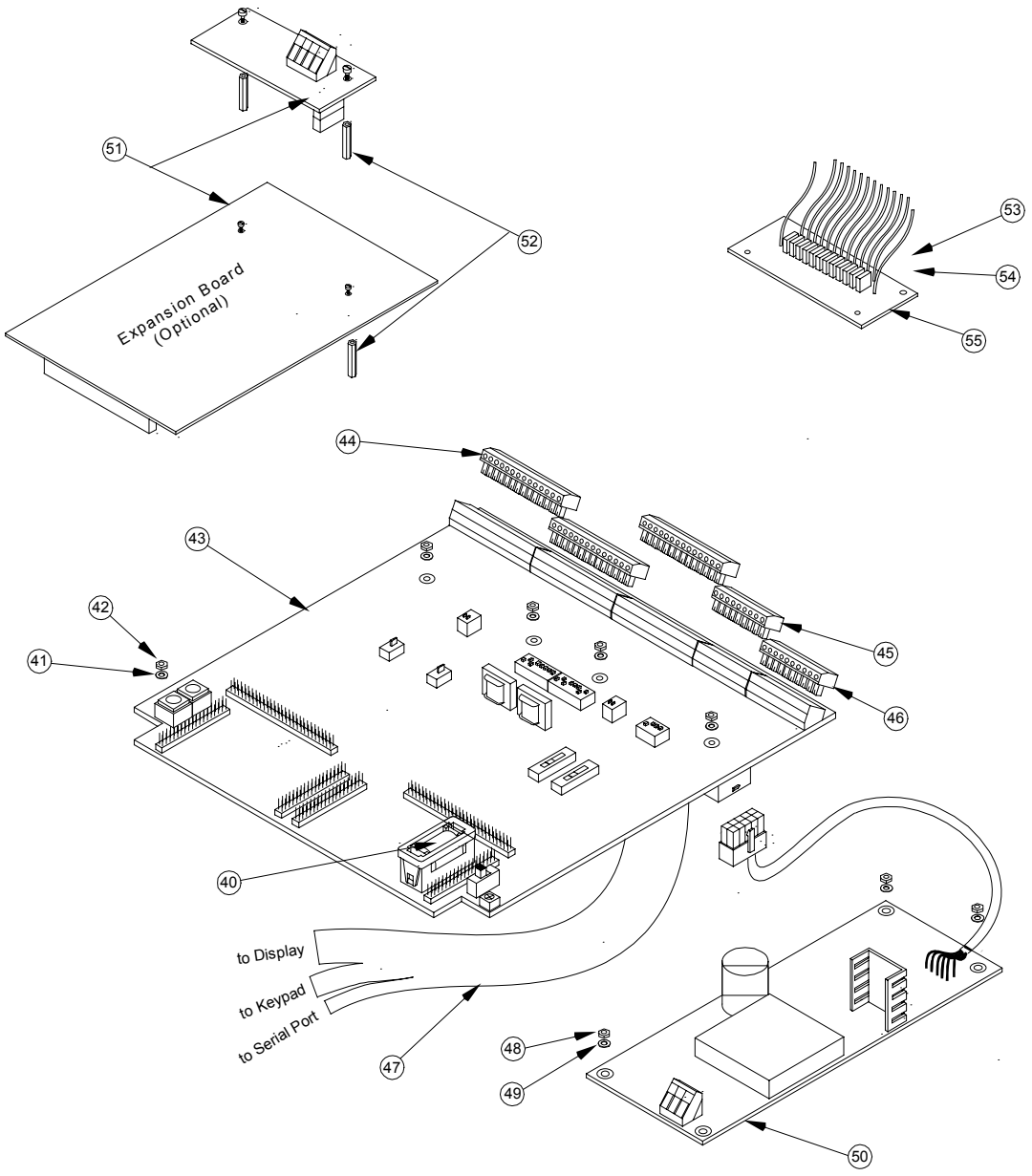
Case, Keypad and Display



Item	Description	Part Number	Per Unit
	CASE		
1	Cover Plate	9A-1130-9118C	1
2	Decal, Wiring Diagram	9A-1130-9100G-21	1
3	Decal, Power Supply / RTI1	9A-1130-9120G	1
4	Screw, Phillips Head, 8-32x3/8", SS	9A-0119-9001J	4
5	Washer, Flat #8	9A-0003-0039K	4
6	Support Pan, 1131 Rack Mount	9A-1130-9117C	1
7	Screw, included with item #32		
8	Nut & Washer, included with item #22		
9	Stand-off, MxF, 6-32x1½", Aluminum	9A-0152-9004T	6
10	Screw, Ph Pan Head, 10-32x1/4", SS	9A-0111-0086J	3
11	Stand-off, MxF, 6-32x1/2", Aluminum	9A-0152-1111T	4
12	Stand-off, MxF, 6-32x1/4", Aluminum	9A-0152-1136T	2

Item	Description	Part Number	Per Unit
13	Stand-off, FxF, 6-32x1/4", Nylon	9A-0152-1134T	4
14	Stand-off, MxF, 6-32x1¼", Aluminum	9A-0152-9003T	4
15	Screw, Slot head, 8-32x3/4", Plated	9A-0119-9002J	1
16	Nut, Hex, 8-32, Plated	9A-0500-1033J	2
17	Washer, Internal tooth, #8, SS	9A-0003-9004K	2
18	Cable, 22 AWG, 2 Conductor, 1 foot	9A-1110-0121T	1
19	Terminal Block	9A-0038-9001T	1
20	Screw, Fillister Head, Slotted, 6-32x1/4", SS	9A-0114-1020J	2
21	Terminal Plug	9A-0028-9002T	1
22	Slider, Pair, c/w mounting hardware	9A-1130-9121T	1
23	Plug, Button, 3/4", Steel nickel plated	9A-1315-0194T	1
24	Screw, included with item #22		
25	Washer, Internal tooth, #6, SS	9A-0003-0070K	16
26	Screw, Ph Pan Head, 6-32x1/4', SS	9A-0119-1013J	16
27	Dataplate, Scanner 1131	9A-1130-1172G	1
28	Nut, included with item #30		
29	Gasket, included with item #30		
30	Connector Assembly, Fischer, Serial port	9A-1130-1135B	1
31	Dust Cap, Spring loaded	9A-0090-1009T	1
32	Handle, Plastic, c/w mounting screws	9A-0022-9002T	2
33	Panel, Front, Rack mount	9A-1130-9116C	1
	KEYPAD & DISPLAY		
34	Keypad, Standard	9A-0097-1013TA	1
35	Stand-off, M 8-32 x F 2-56x1/4", Aluminum	9A-0152-9006C	4
36	Lens, Lexan	9A-1130-1019C	1
37	Washer, #2, Teflon	9A-0003-1092K	4
38	Screw, Slot Round Head, 2-56x1/4", SS	9A-0119-1002J	4
39	Display, Standard, 4 x 20	9A-1131-0403C	1
	Display, Backlit, 4 x 20	9A-1131-0401C	

Boards



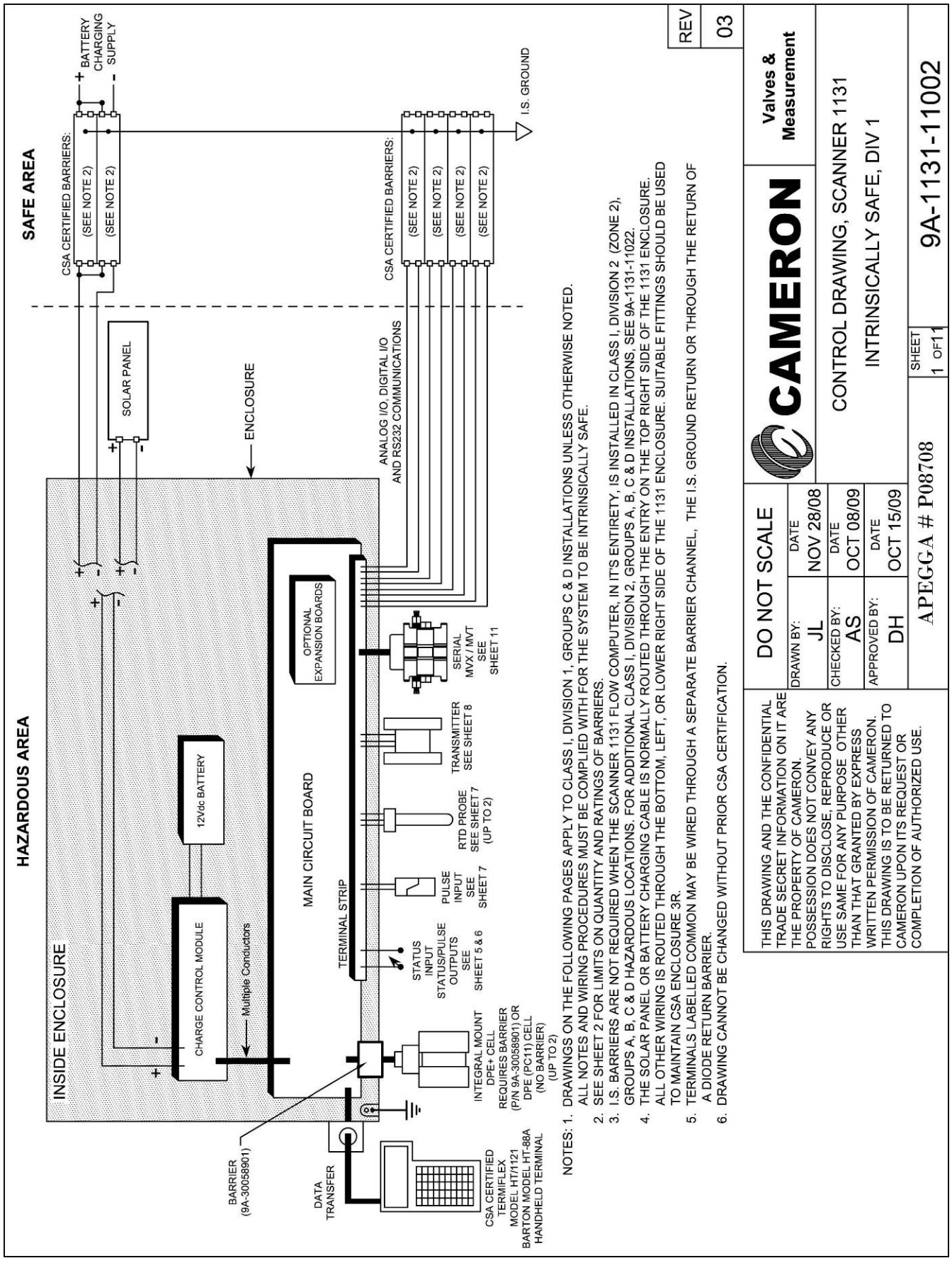
Item	Description	Part Number	Per Unit
	BOARDS		
40	Battery, lithium, 3.6V	9A-0130-9018T	1
41	Washer, Internal tooth, #6, SS	9A-0003-0070K	6
42	Nut, Hex, 6-32, SS	9A-0500-0021J	6
43	Main Board (refer to model # field CODES 5, 6 & 7)		1
	CODES **OPTIONS**		
	00 IO 00, 1RS232 1 SW, no C/XM	9A-1131-0100000239	
	16 IO 16, 2RS232 2 SW, no C/XM	9A-1131-0116020739	

Item	Description		Part Number	Per Unit
	17	IO 16, 2RS232 2 SW, C/XM	9A-1131-0116021739	
	26	IO 26, 2RS232 2 SW, C/XM	9A-1131-0126021739	
44	Terminal Plug, 14 pin for pins 20 – 61		9A-1131-1024T	3
45	Terminal Plug, 9 pin for pins 11 – 19		9A-1131-1022T	1
46	Terminal Plug, 10 pin for pins 1 – 10		9A-1131-1023T	1
47	Ribbon Cable Assembly, 1131R		9A-1130-9026B	1
48	Nut, Hex, 6-32, SS		9A-0500-0021J	4
49	Washer, Internal tooth, #6, SS		9A-0003-0070K	4
50	Power supply board, 24V Isolated		9A-0168-1020T	1
51	Expansion Board			As reqd.
	Code 01 – Remote console serial port		9A-0155-1018T	
	Code 02 – Communications accessory		9A-0155-1019T	
	Note that the above boards must be in Slot #1.			
	CDO1			
	40	1 Comm. Port only	9A-1130-9138C40	
	41	4 Digital I/O only	9A-1130-9138C41	
	42	1 Comm. Port, 4 Digital I/O	9A-1130-9138C42	
	43	1 Comm. Port, CCA switch	9A-1130-9138C43	
	44	4 Digital I/O, CCA switch	9A-1130-9138C44	
	45	1 Comm. Port, 4 Digital I/O, CCA switch	9A-1130-9138C45	
	CAO1			
	50	2 Analog Out only	9A-1130-9108C02	
	51	4 Analog Out only	9A-1130-9108C04	
	53	1 Comm. Port, 2 Analog Out	9A-1130-9108C12	
	54	1 Comm. Port, 4 Analog Out	9A-1130-9108C14	
	55	2 Analog Out, CCA switch	9A-1130-9108C22	
	56	4 Analog Out, CCA switch	9A-1130-9108C24	
	58	1 Comm. Port, 2 Analog Out, CCA switch	9A-1130-9108C32	
	59	1 Comm. Port, 4 Analog Out, CCA switch	9A-1130-9108C34	
	DIO1			
	60	2 Frequency Inputs	9A-1130-9109C20	
	61	5 Frequency Inputs	9A-1130-9109C50	
	62	2 Frequency Inputs, Phase Discrim.	9A-1130-9109C21	
	63	5 Frequency Inputs, Phase Discrim.	9A-1130-9109C51	
	66	2 Densitometer Inputs	9A-1130-9109C24	
	69	5 Densitometer Inputs	9A-1130-9109C54	
	ASO1			
	03	3 Status/Pulse Output	9A-0071-1030T	
	11	1 Analog Output, 1 Status/Pulse Output	9A-0071-1029T	
	30	3 Analog Output	9A-0071-1031T	
	33	3 Analog Output, 3 Status/Pulse Output	9A-0071-1028T	
52	Stand-off, F x F 6-32x3/4”, Aluminum		9A-0152-9005T	2
53	Nut, Hex, 6-32, SS		9A-0500-0021J	2
54	Washer, Internal tooth, #6, SS		9A-0003-0070K	2
55	Board, Analog Input Resistor, 12, 1131R		9A-1131-1005B-02	1
	Not shown			
	Config lock kit		9A-1131-1012B	

APPENDIX A: Drawings

Drawing 9A-1131-11002: Scanner 1131 Wiring Diagrams, Div. 1 (Zone 1)
Drawing 9A-1131-11022: Scanner 1131 Wiring Diagrams, Div. 2 (Zone 2)

Locations	*Drawings*	*Page*
Div. 1	**Drawing 1: Installation**	**154**
	Drawing 2: Barrier Ratings	**155**
	Drawing 3: Power Supply	**156**
	Drawing 4: Communications (RS232C) Serial Ports	**157**
	Drawing 5: Status Inputs	**158**
	Drawing 6: Status/Pulse Outputs	**159**
	Drawing 7: Pulse/RTD Inputs	**160**
	Drawing 8: Six Analog Inputs	**161**
	Drawing 9: Twelve Analog Inputs	**162**
	Drawing 10: Analog Outputs	**163**
	Drawing 11: MVT Inputs	**164**
Div. 2 (Zone 2)	**Drawing 12: Installation**	**165**
	Drawing 13: Power Supply	**166**
	Drawing 14: Communications (RS232) Serial Ports	**167**
	Drawing 15: Status Inputs	**168**
	Drawing 16: Status/Pulse Outputs	**169**
	Drawing 17: Pulse/RTD Inputs	**170**
	Drawing 18: Six Analog Inputs	**171**
	Drawing 19: Twelve Analog Inputs	**172**
	Drawing 20: Analog Outputs	**173**
	Drawing 21: MVX Inputs	**174**



Drawing 1: Installation (Div. 1 Locations)

BARRIER RATINGS		CLASS I, DIVISION 1, GROUPS C& D CONFIGURATIONS											
VOLTS (MAX.)	Ω (MIN.)	A	B	C	D	E	F	G	H	I	J	K	L
+28.5 Vdc	200												2
+28.5 Vdc	300	4	3	2	1		2	1	2	3	1	2	1
+22 Vdc	200		2	3	5	7		2			3	2	
+16 Vdc	100	6	5	5	4	2	5	6	10	8	7	7	6
+12 Vdc	800	8	8	8	8	8	8	8	8	8	8	8	8
±12 Vac	100						1	1					
±12 Vac	1000	6	8	9	9	9	4	2	8	8	9	9	6

BARRIER RATINGS		CLASS I, DIVISION 1, GROUP D CONFIGURATIONS											
VOLTS (MAX.)	Ω (MIN.)	M	N	O	P	Q	R	S	T	U	V	W	X
+28.5 Vdc	200												2
+28.5 Vdc	300	5	4	3	2	1	2	1	4	-	3	4	2
+22 Vdc	200		2	4	6	8		2		-	3	2	2
+16 Vdc	100	10	8	6	4	3			12	-	8	7	8
+12 Vdc	800	10	8	8	8	8	8	8	8	-	8	8	8
±12 Vac	100						5	2		-			
±12 Vac	1000	9	8	9	9	9	9	6	9	-	9	9	9

NOTES:

1. EACH SCANNER 1131 INSTALLATION MUST COMPLY TO ONE OF THE CONFIGURATIONS SHOWN (ALTERNATE BARRIER COMBINATIONS ARE LISTED IN DOCUMENT 9A-1131-11032). PARTIAL INSTALLATIONS OF A PARTICULAR CONFIGURATION CAN BE CONSIDERED INTRINSICALLY SAFE.

2. SINGLE BARRIERS MAY BE SUBSTITUTED FOR MULTIPLE BARRIERS OF THE SAME VOLTAGE RATING PROVIDED THE NET RESISTANCES ARE IN COMPLIANCE WITH THE ABOVE TABLE.

   EXAMPLE: TWO 28.5 V/150 Ω BARRIERS CAN BE SUBSTITUTED FOR FOUR 28.5 V/300 Ω BARRIERS.

3. DIODE RETURN BARRIERS MAY BE SUBSTITUTED FOR SINGLE BARRIERS.

4. ANY BARRIERS MEETING THE RATINGS SHOWN ON THIS PAGE MAY BE SUBSTITUTE FOR THE RECOMMENDED BARRIERS SHOWN ON PAGES 3 THROUGH 11.

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CONTROL DRAWING, SCANNER 1131
INTRINSICALLY SAFE, DIV 1

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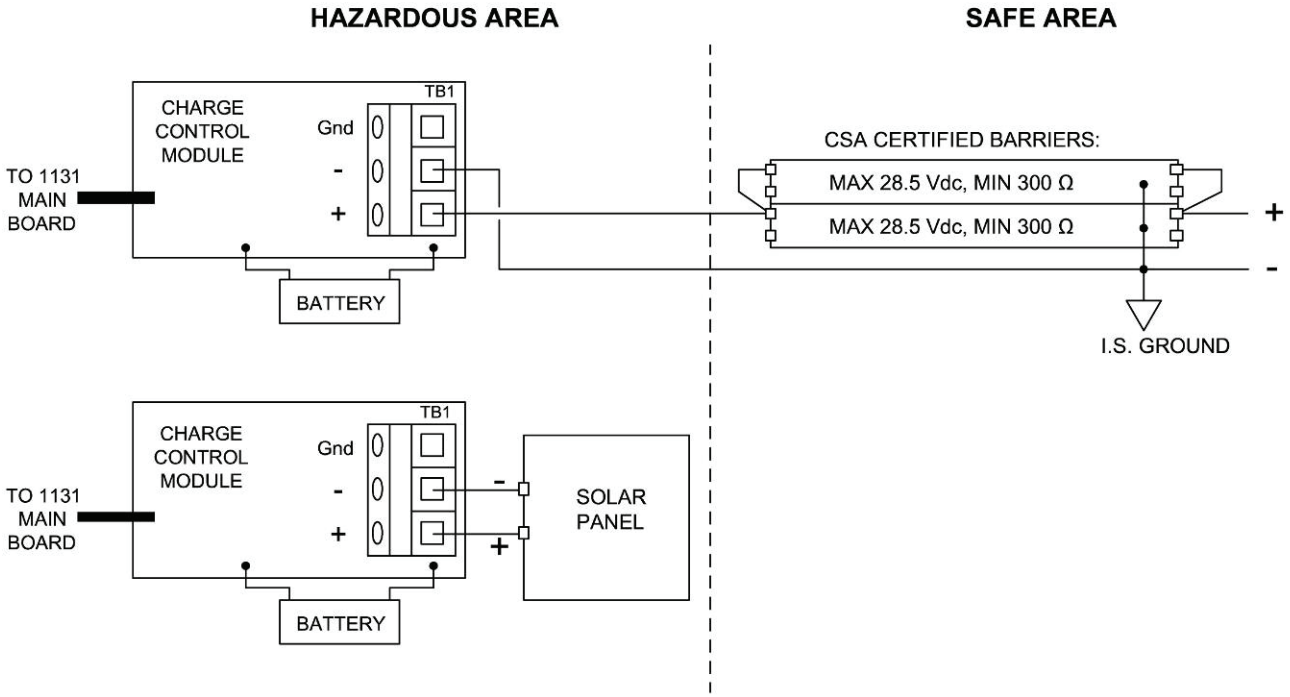
Drawing 2: Barrier Ratings

POWER SUPPLY



NOTES:

1. SEE SHEET 1 AND 2 FOR GENERAL NOTES.
2. SEE SHEET 2 FOR LIMITS ON QUANTITIES AND RATINGS OF BARRIERS.
3. SOLAR PANELS: **10 WATT** 9A-0097-1018T: BP SOLAREX MSX-10
   9A-0097-9006T-10: SEIMENS SM-10
   OR ANY SOLAR PANEL OR COMBINATION OF SOLAR PANELS NOT EXCEEDING THE FOLLOWING PARAMETERS:

   - FOR CLASS I, DIVISION 1 (ZONE 1), GROUPS C&D HAZARDOUS LOCATIONS: *U*O=22V, *I*O=0.78A OR *U*O=20V, *I*O=1.06A
   - FOR CLASS I, DIVISION 1 (ZONE 1), GROUP D HAZARDOUS LOCATIONS: *U*O=21V, *I*O=1.22A OR *U*O=19V, *I*O=1.66A

   WHERE: '*U*O' IS OPEN CIRCUIT VOLTAGE, '*I*O' IS SHORT CIRCUIT CURRENT IN AMPS.

4. BATTERIES: **32AH** 9A-0130-9014T - PANASONIC LCL12V33P OR LC-LA1233P(a) (LCL-12V33AP)
   ALTERNATES:SONNENSHEIN (A212/32G)
   DYNASTY U1-31
   POWERSONIC PS-12330
   CONCORD GPC1234

5. POWER SUPPLY MODULE:
   ORDER CODE 11: 9A-1131-0301C (3655802) CHARGE CONTROL MODULE

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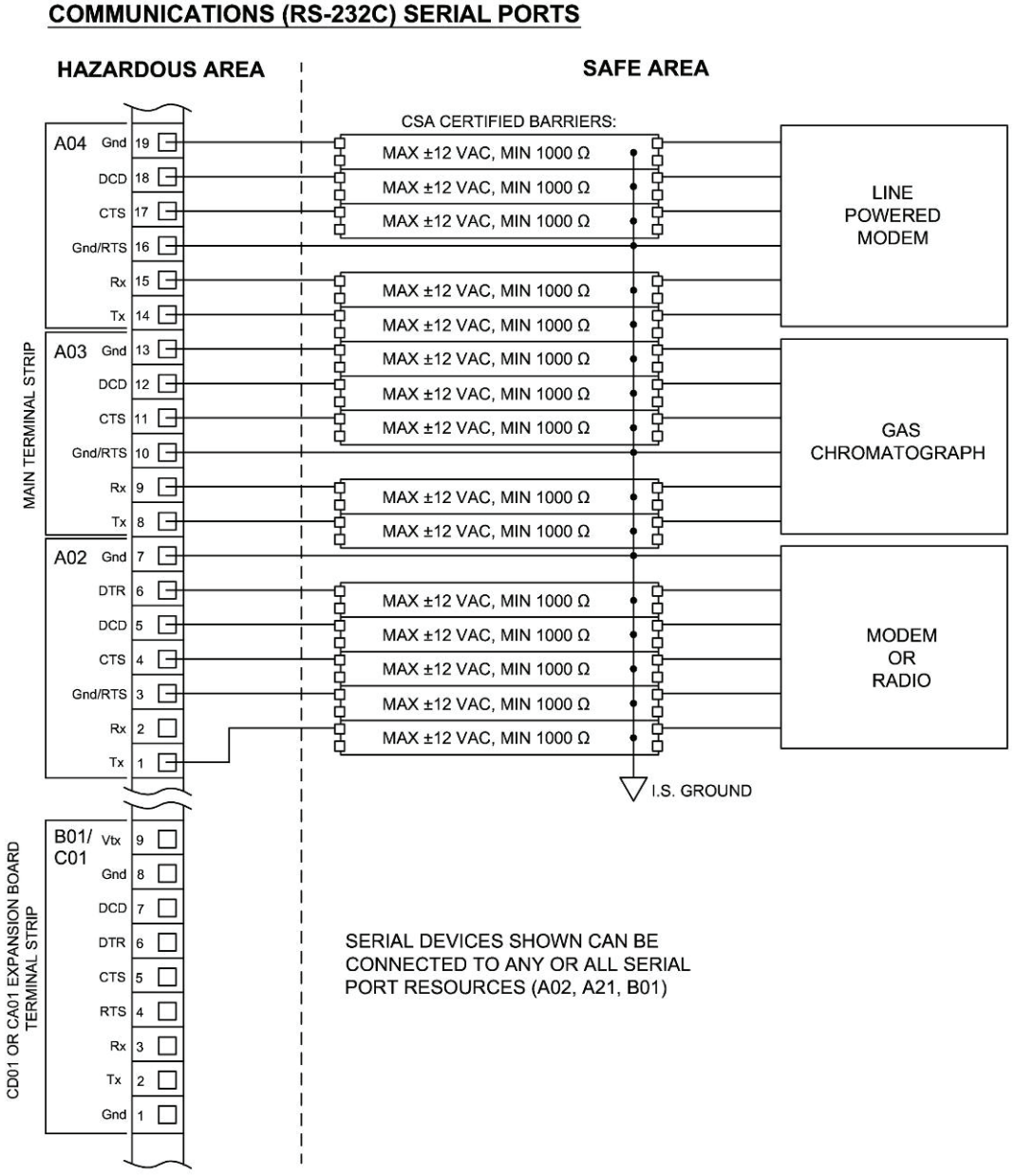
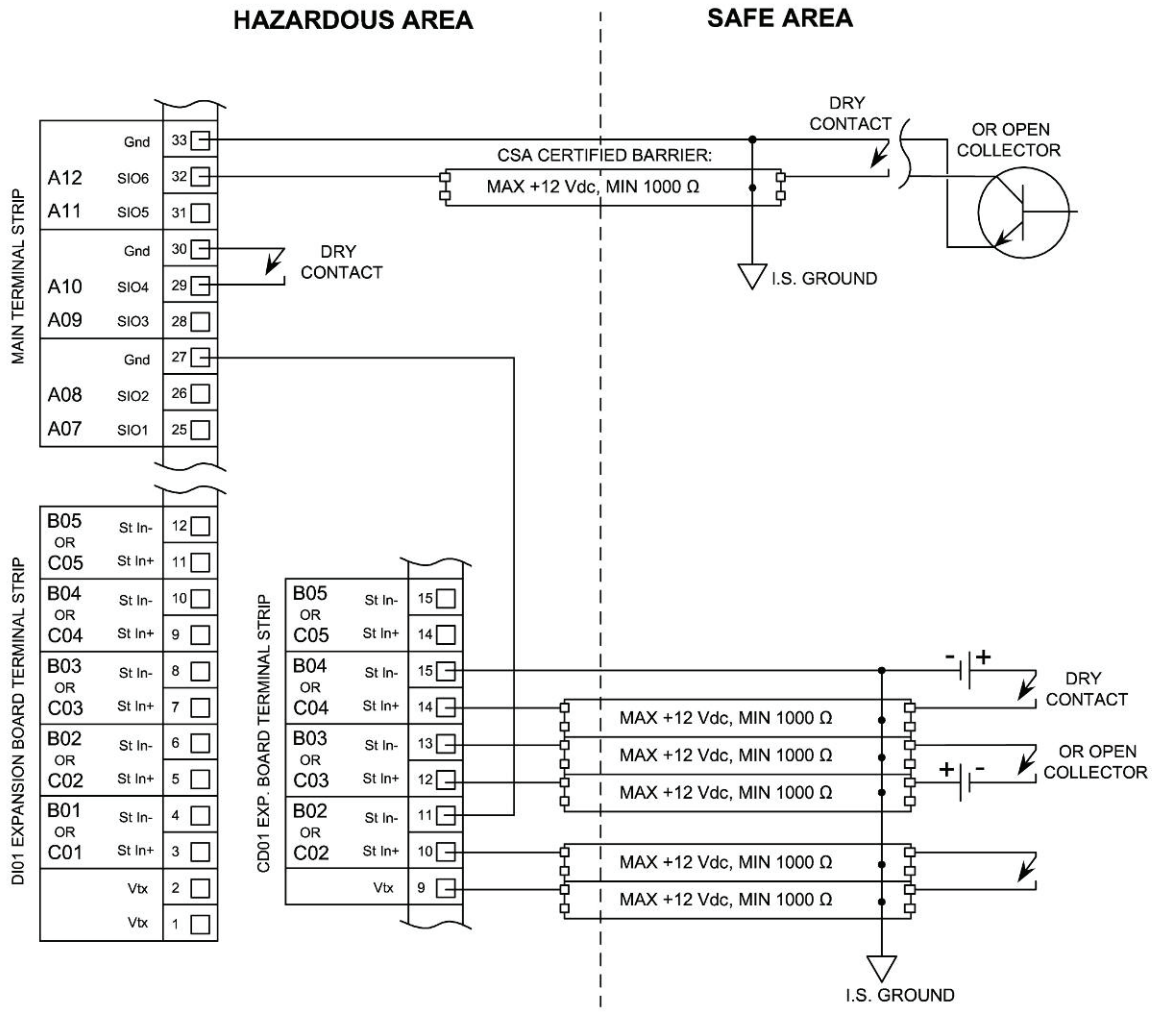
Drawing 3: Power Supply (Div. 1)



Drawing 4: Communications (RS-232C) Serial Ports (Div. 1)

STATUS INPUTS



STATUS INPUT WIRING AS SHOWN CAN BE CONNECTED TO ANY OR ALL DIGITAL INPUT / OUTPUT RESOURCES SHOWN.

NOTES:
1. SEE SHEET 1 AND 2 FOR GENERAL NOTES.
2. SEE SHEET 2 FOR LIMITS ON QUANTITIES AND RATINGS OF BARRIERS.

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CONTROL DRAWING, SCANNER 1131
INTRINSICALLY SAFE, DIV 1

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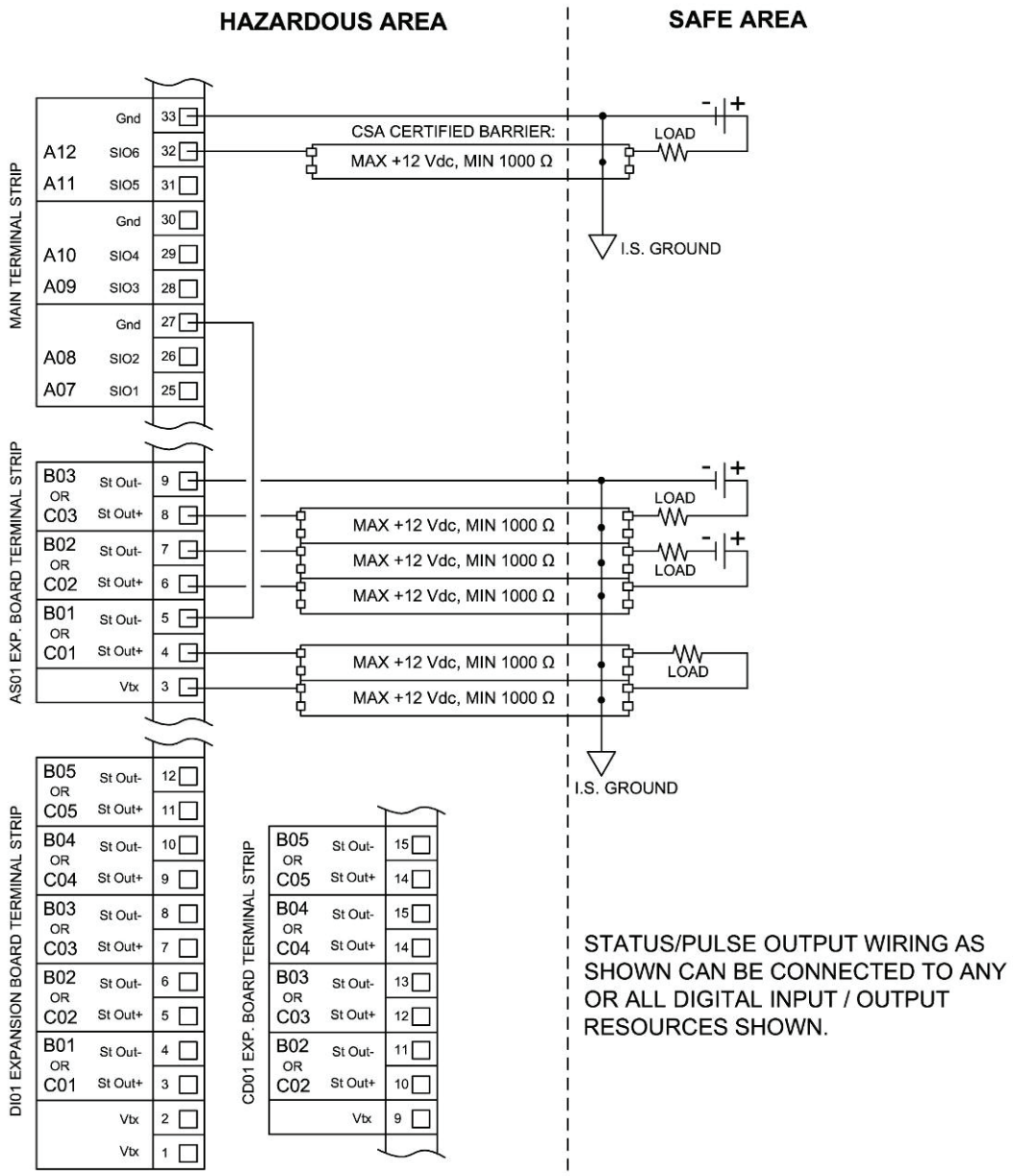
Drawing 5: Status Inputs (Div. 1)

STATUS/PULSE OUTPUTS



NOTES:
1. SEE SHEET 1 AND 2 FOR GENERAL NOTES.
2. SEE SHEET 2 FOR LIMITS ON QUANTITIES AND RATINGS OF BARRIERS.

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CONTROL DRAWING, SCANNER 1131
INTRINSICALLY SAFE, DIV 1

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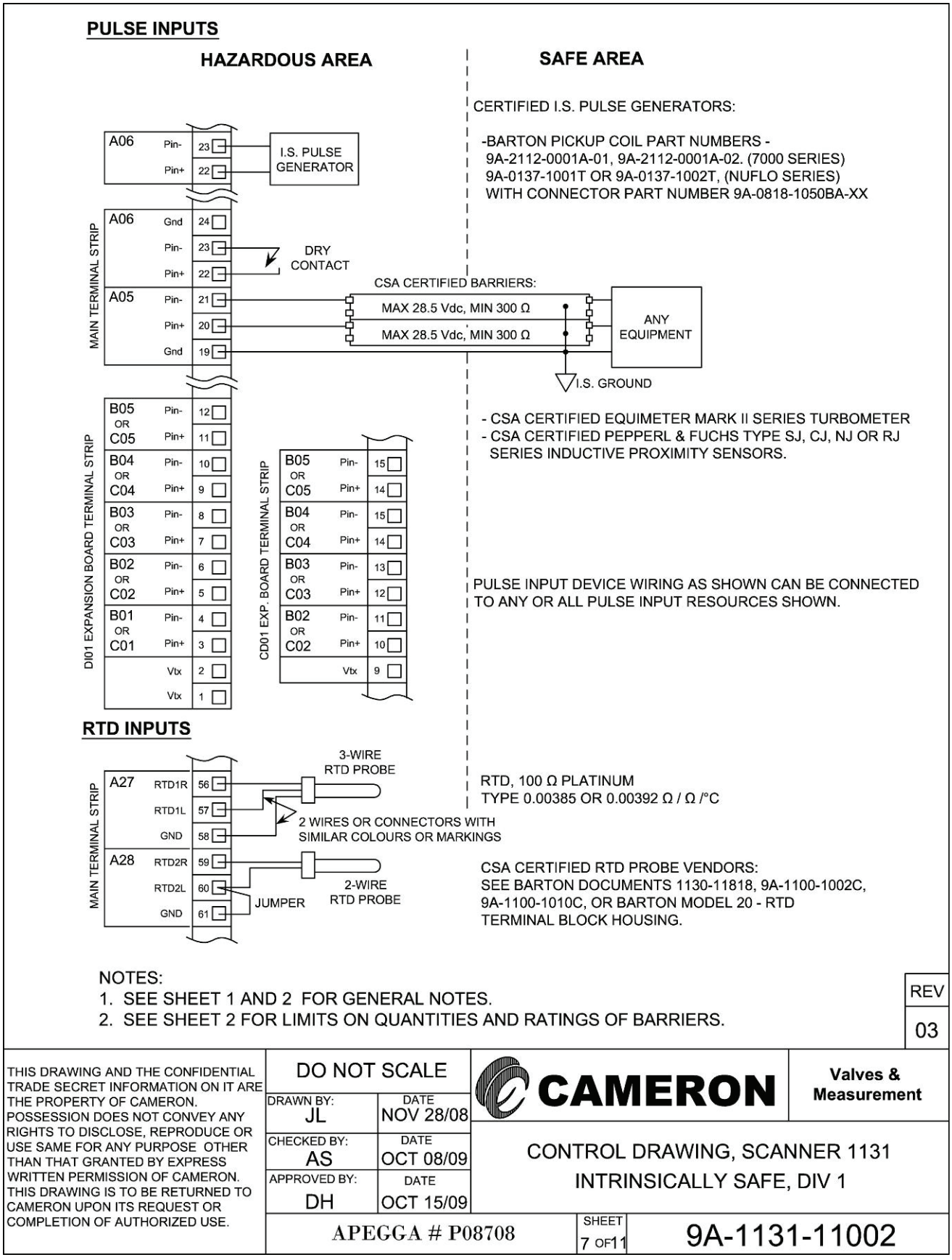
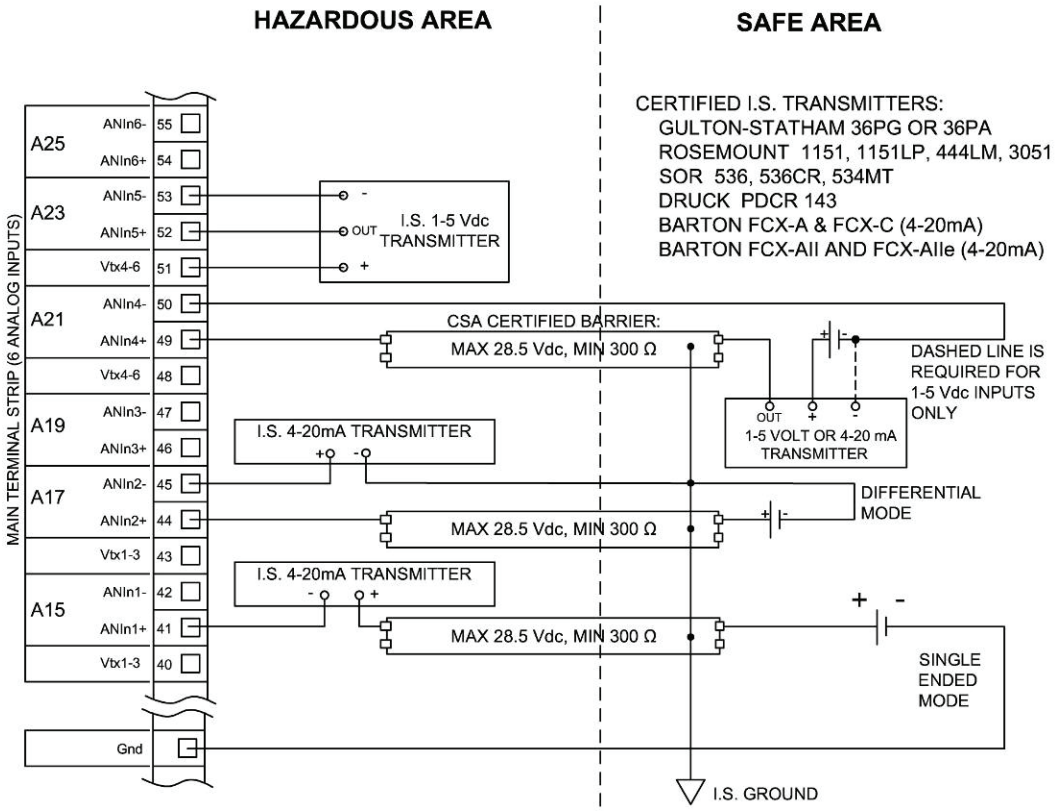
Drawing 6: Status/Pulse Outputs (Div. 1)



Drawing 7: Pulse/RTD Inputs (Div. 1)

ANALOG INPUTS



NOTES:
1. SEE SHEET 1 AND 2 FOR GENERAL NOTES.
2. SEE SHEET 2 FOR LIMITS ON QUANTITIES AND RATINGS OF BARRIERS.

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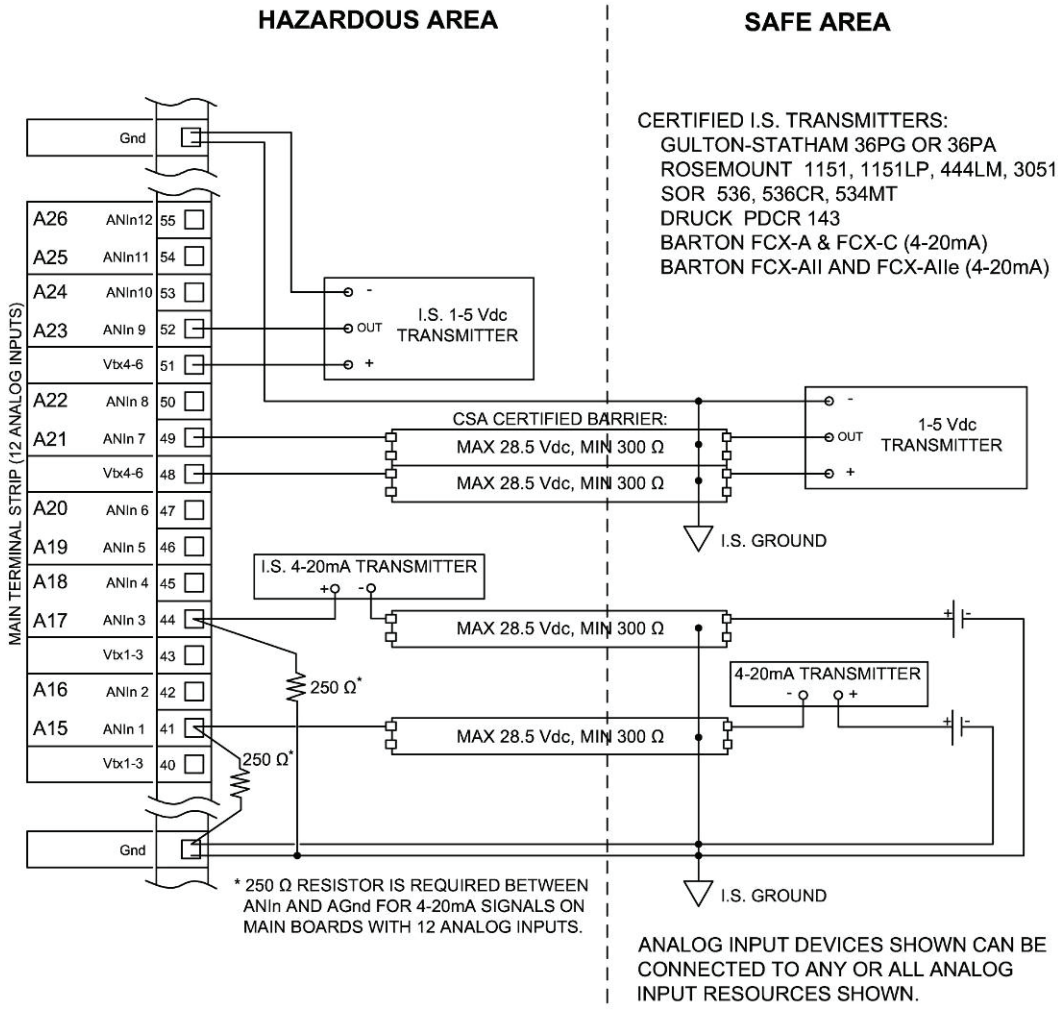
CONTROL DRAWING, SCANNER 1131
INTRINSICALLY SAFE, DIV 1

APEGGA # P08708 — SHEET 8 OF 11 — 9A-1131-11002

Drawing 8: Six Analog Inputs (Div. 1)

ANALOG INPUTS



NOTES:
1. SEE SHEET 1 AND 2 FOR GENERAL NOTES.
2. SEE SHEET 2 FOR LIMITS ON QUANTITIES AND RATINGS OF BARRIERS.

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CONTROL DRAWING, SCANNER 1131
INTRINSICALLY SAFE, DIV 1

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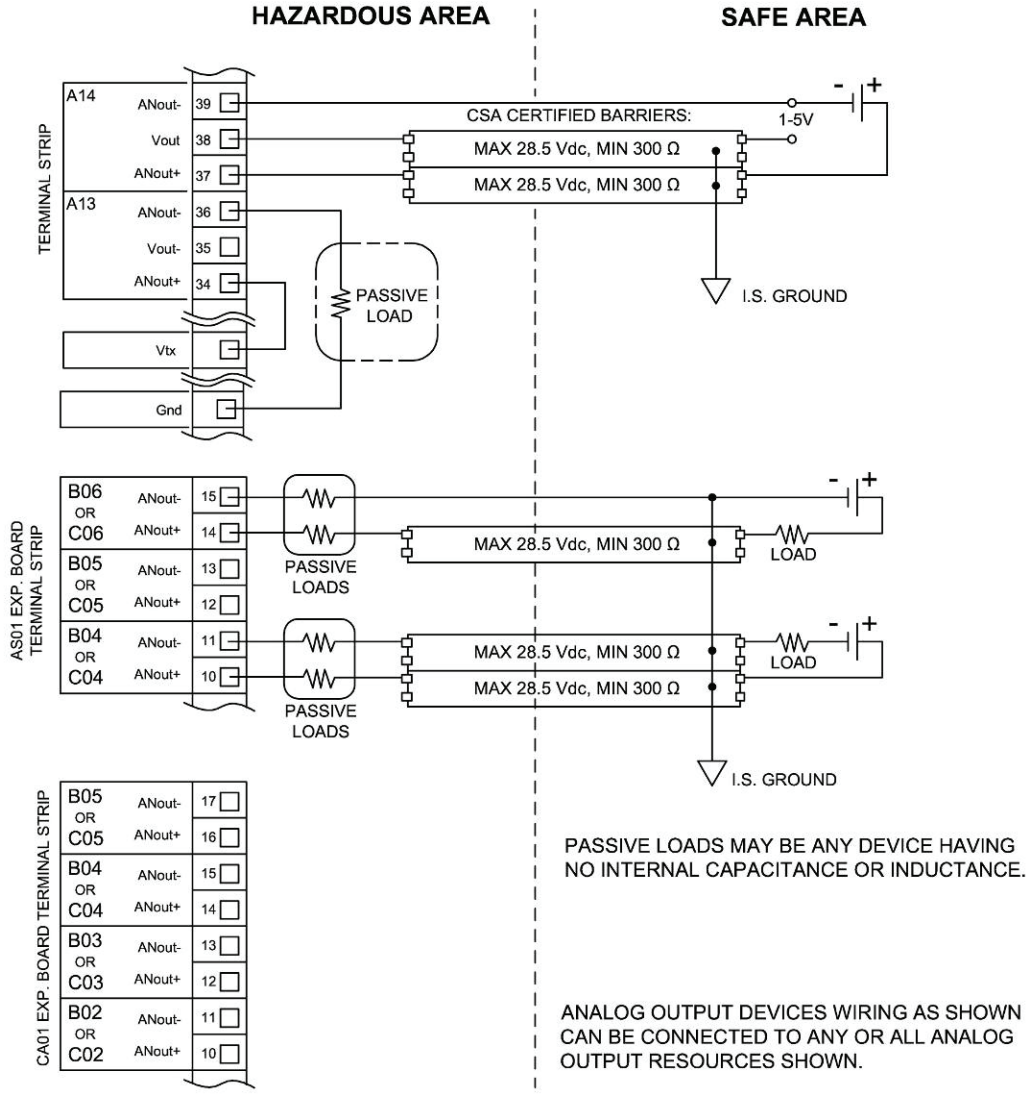
Drawing 9: Twelve Analog Inputs (Div. 1)

ANALOG OUTPUTS



NOTES:
1. SEE SHEET 1 AND 2 FOR GENERAL NOTES.
2. SEE SHEET 2 FOR LIMITS ON QUANTITIES AND RATINGS OF BARRIERS.

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CONTROL DRAWING, SCANNER 1131
INTRINSICALLY SAFE, DIV 1

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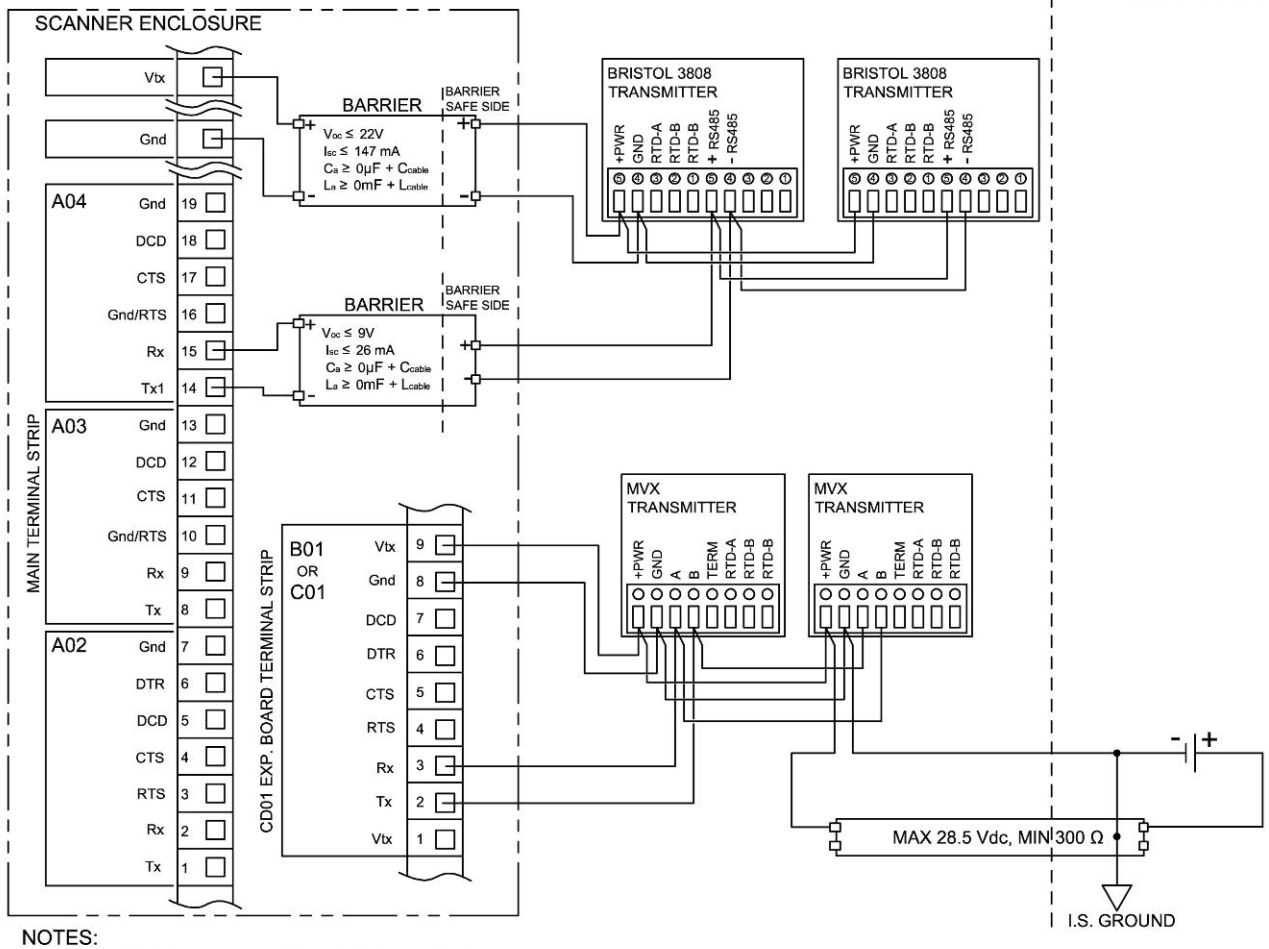
Drawing 10: Analog Outputs (Div. 1)



NOTES:

1. SEE SHEET 1 AND 2 FOR GENERAL NOTES.
2. SEE SHEET 2 FOR LIMITS ON QUANTITIES AND RATINGS OF BARRIERS.
3. RS485 SERIAL PORTS MAY BE CONNECTED TO MVX OR BRISTOL 3808 TRANSMITTERS AS SHOWN WHEN THE SCANNNER 1131 FLOW COMPUTER AND MVX OR BRISTOL 3808 TRANSMITTERS ARE INSTALLED IN CLASS 1, DIV 1, GROUPS C & D HAZARDOUS LOCATIONS. THE BARRIERS SHOWN ARE REQUIRED FOR CONNECTION TO BRISTOL 3808.
4. FOR DIVISION 1 APPLICATIONS, THE SCANNER 1131 TRANSMITTER POWER SUPPLY (Vtx) IS A SOFTWARE CONTROLLED (ON/OFF DURATION) 9 - 11Vdc SUPPLY LIMITED TO 15mA MAXIMUM. EXTERNAL POWER MAY ALSO BE USED. FOR DIVISION 2 APPLICATIONS USING THE 24 Vdc SUPPLY, Vtx IS AN 8-28 Vdc SUPPLY LIMITED TO 240 mA MAXIMUM.
5. A MAXIMUM OF TEN MVX OR BRISTOL 3808 TRANSMITTERS CAN BE CONNECTED TO ANY OR ALL SERIAL PORT RESOURCES SHOWN.
6. POWER BARRIERS TO THE BRISTOL 3808 CAN BE MOUNTED INSIDE THE SCANNER 1131 AND CONNECTED TO THE VTX OR IN THE SAFE AREA CONNECTED TO AN EXTERNAL SUPPLY.

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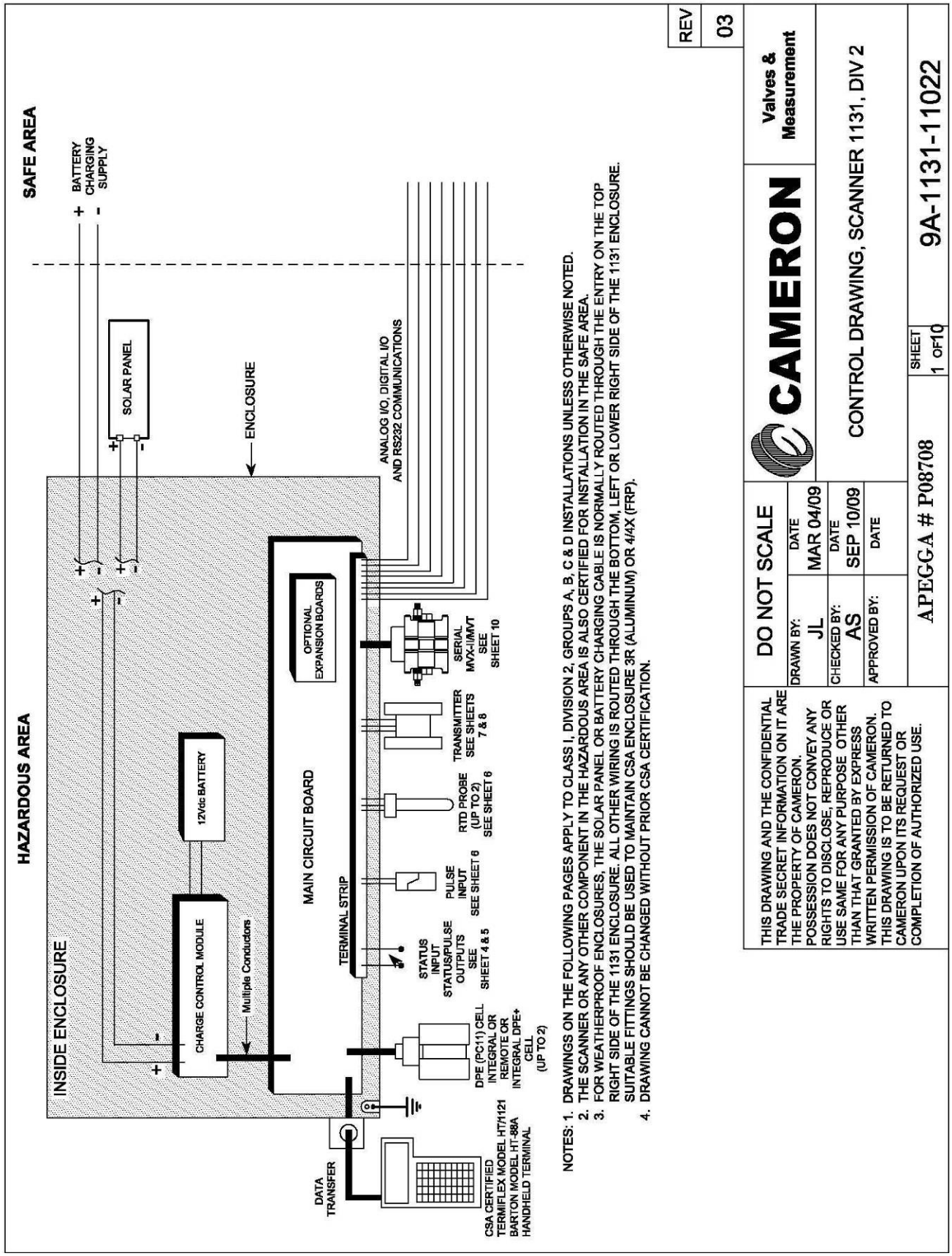
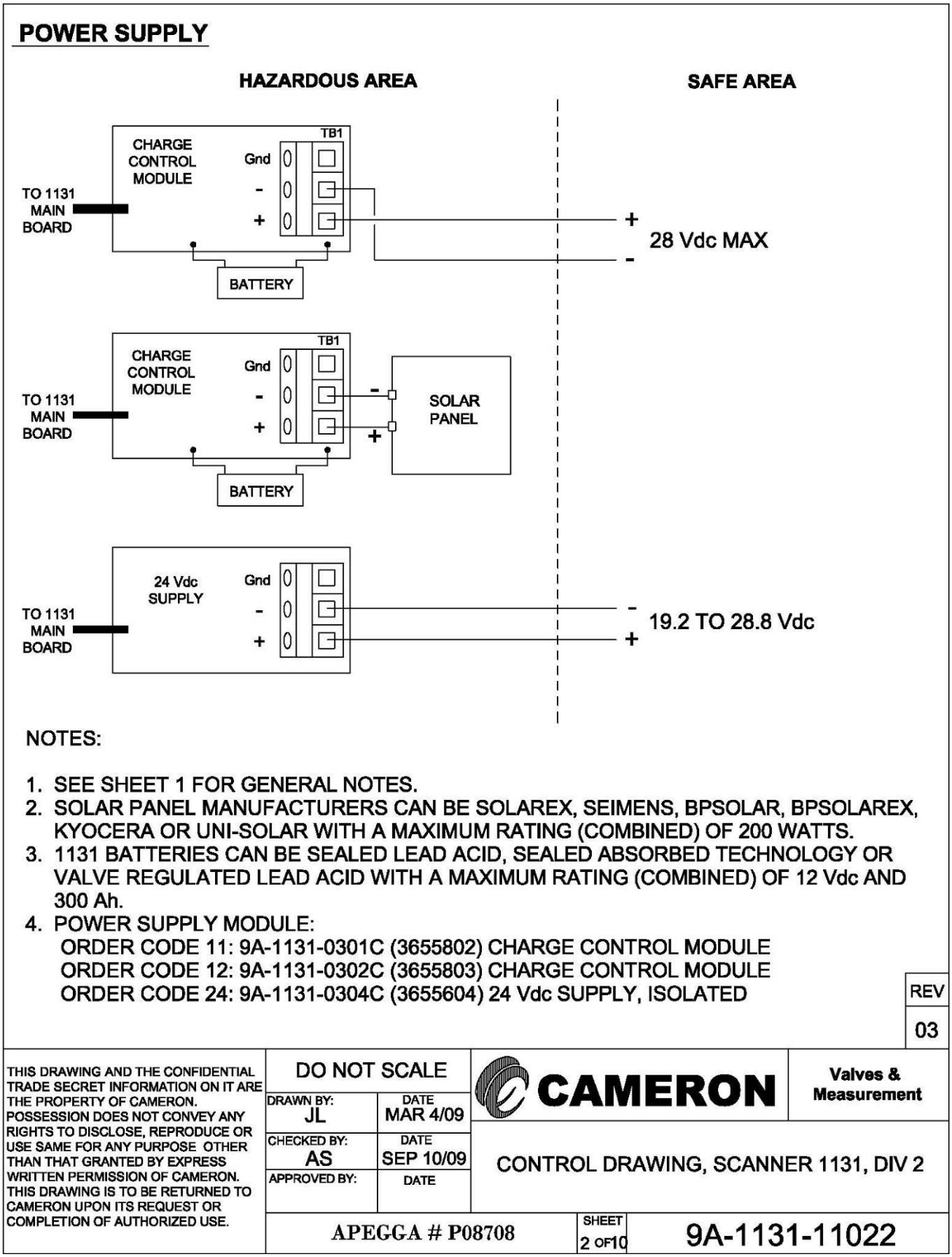
APPROVED BY: DH	DATE OCT 15/09		
APEGGA # P08708	SHEET 11 OF 11	9A-1131-11002	

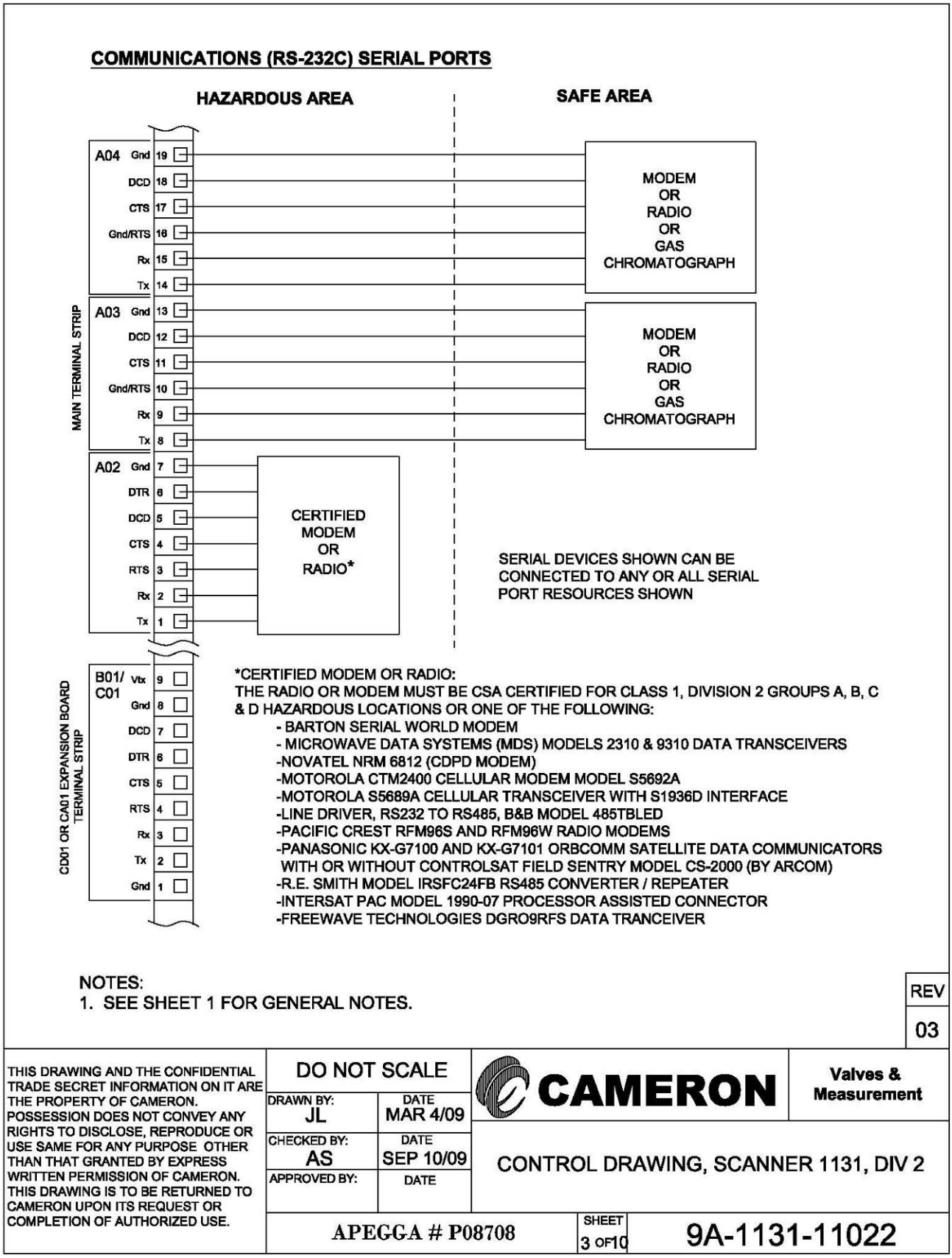
Drawing 11: MVX Inputs (Div. 1)



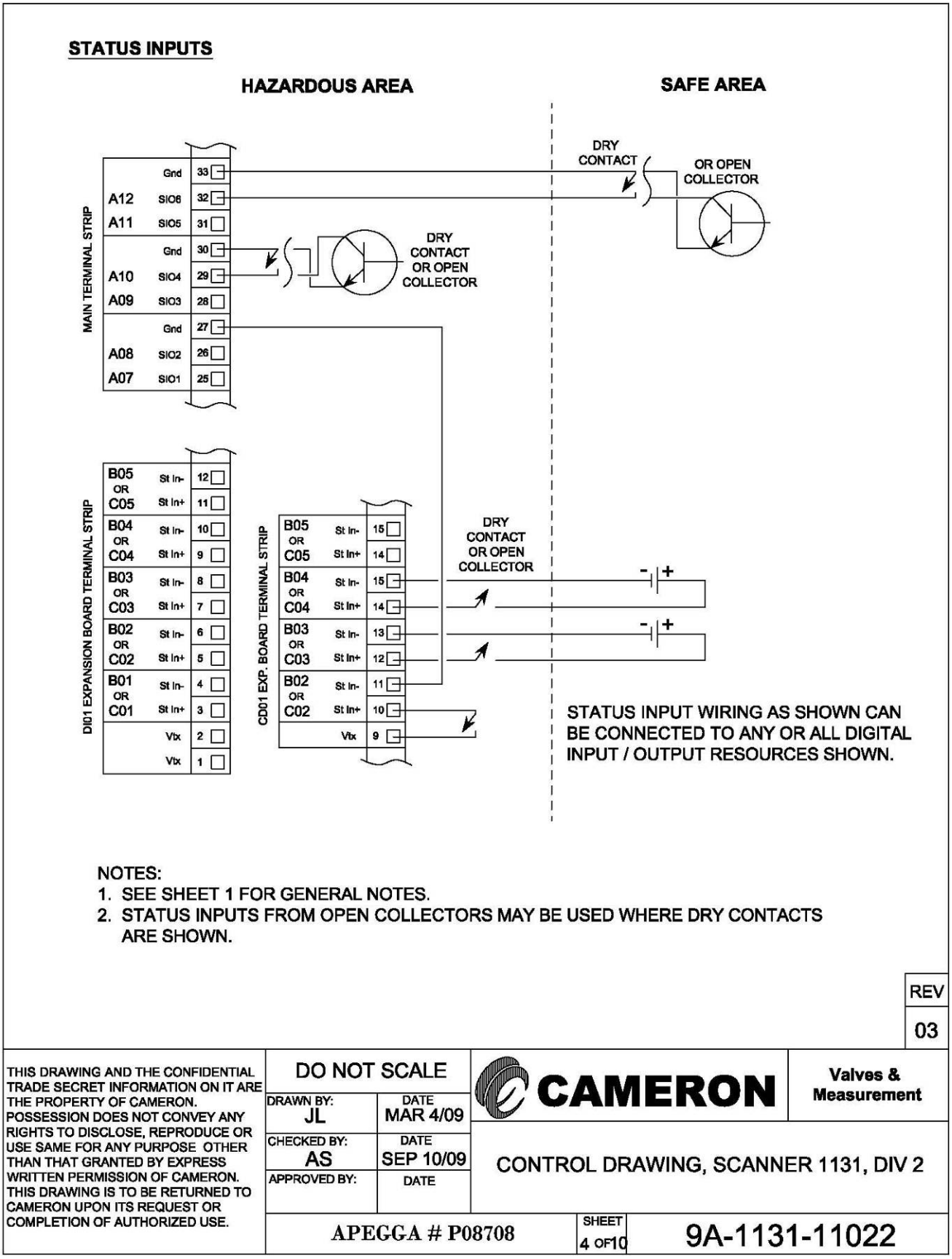
Drawing 12: Installation (Div. 2 or Zone 2 Locations)



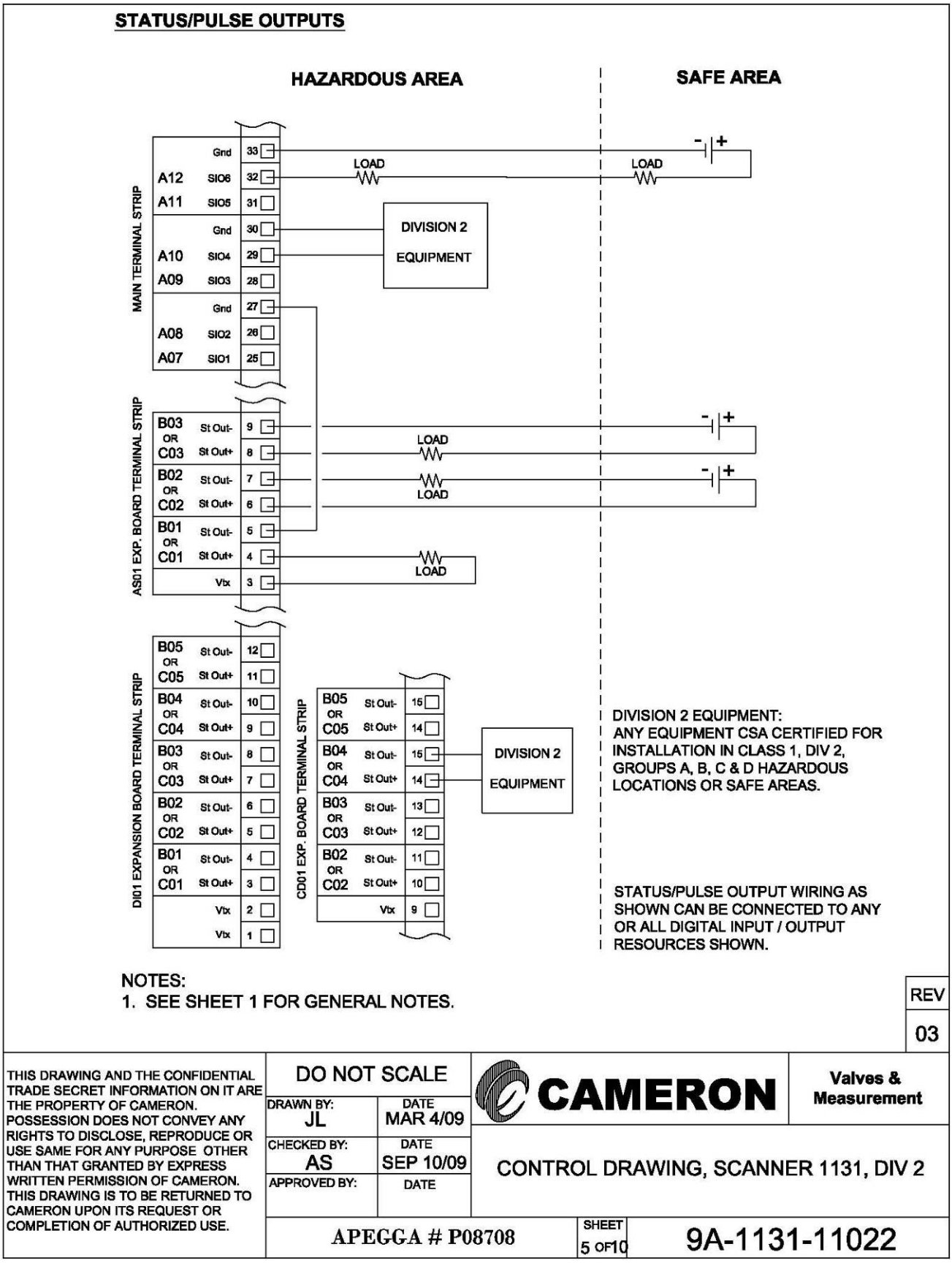
Drawing 13: Power Supply (Div. 2 or Zone 2)



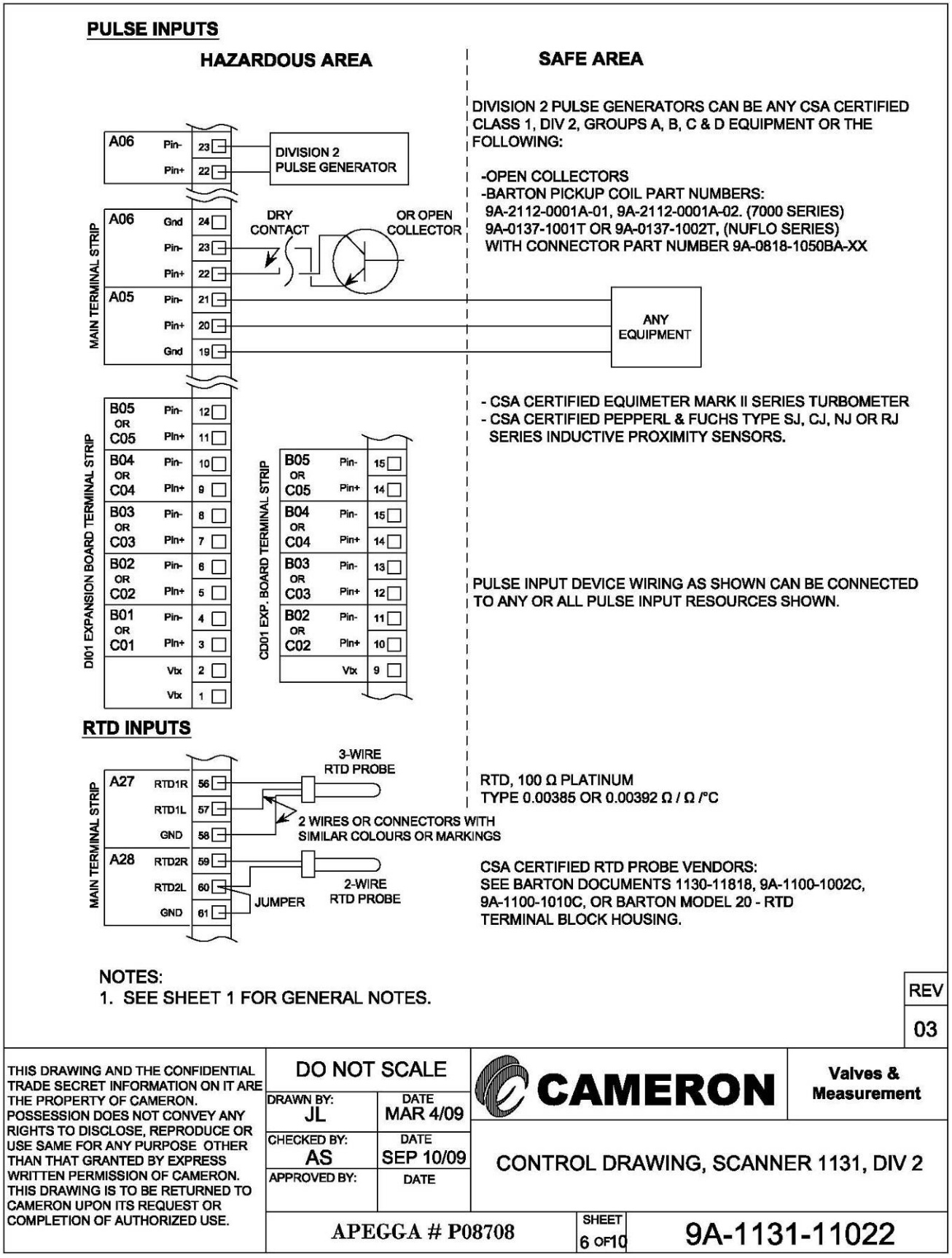
Drawing 14: Communications (RS232) Serial Ports (Div. 2 or Zone 2)



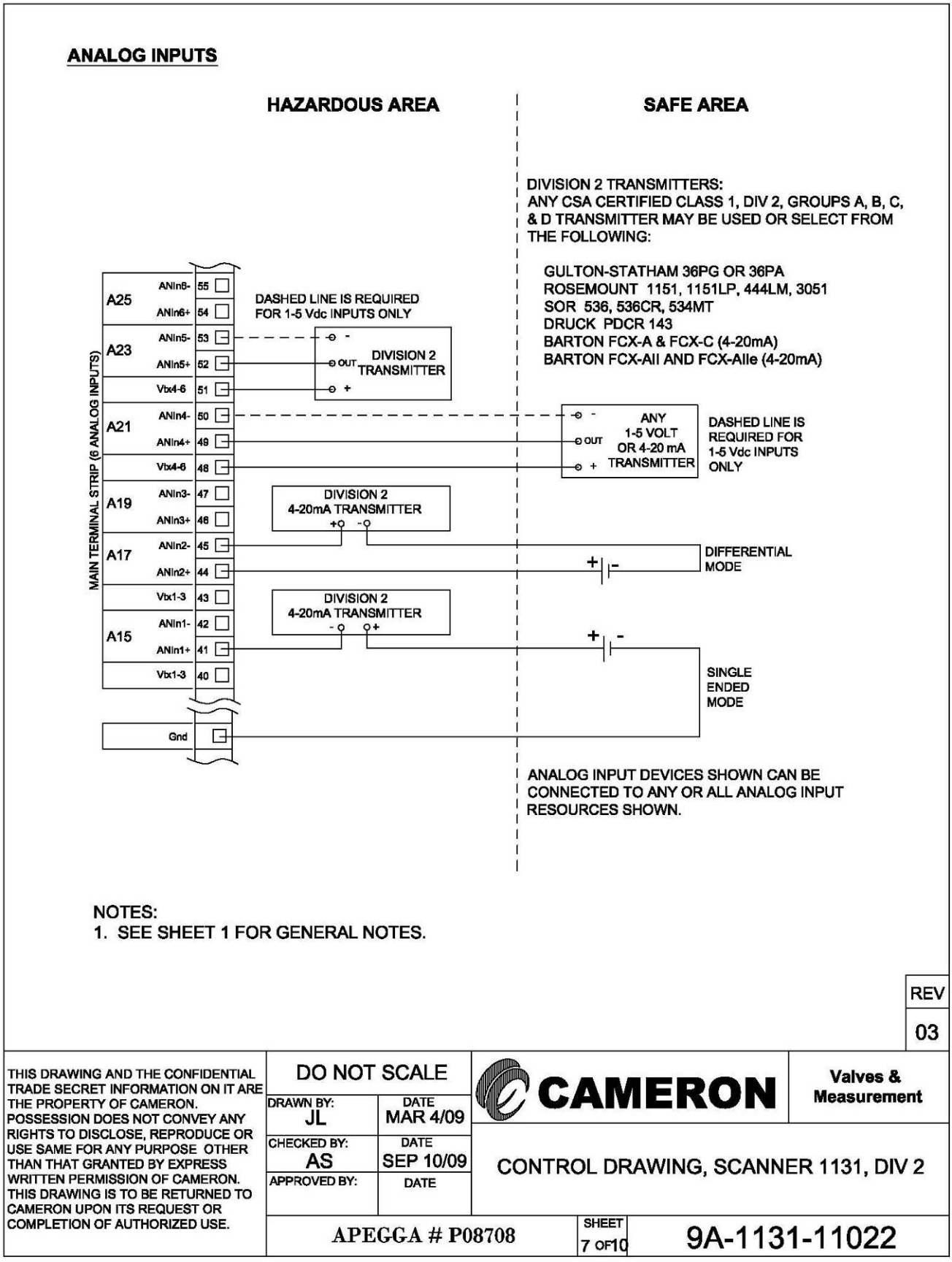
Drawing 15: Status Inputs (Div. 2 or Zone 2)



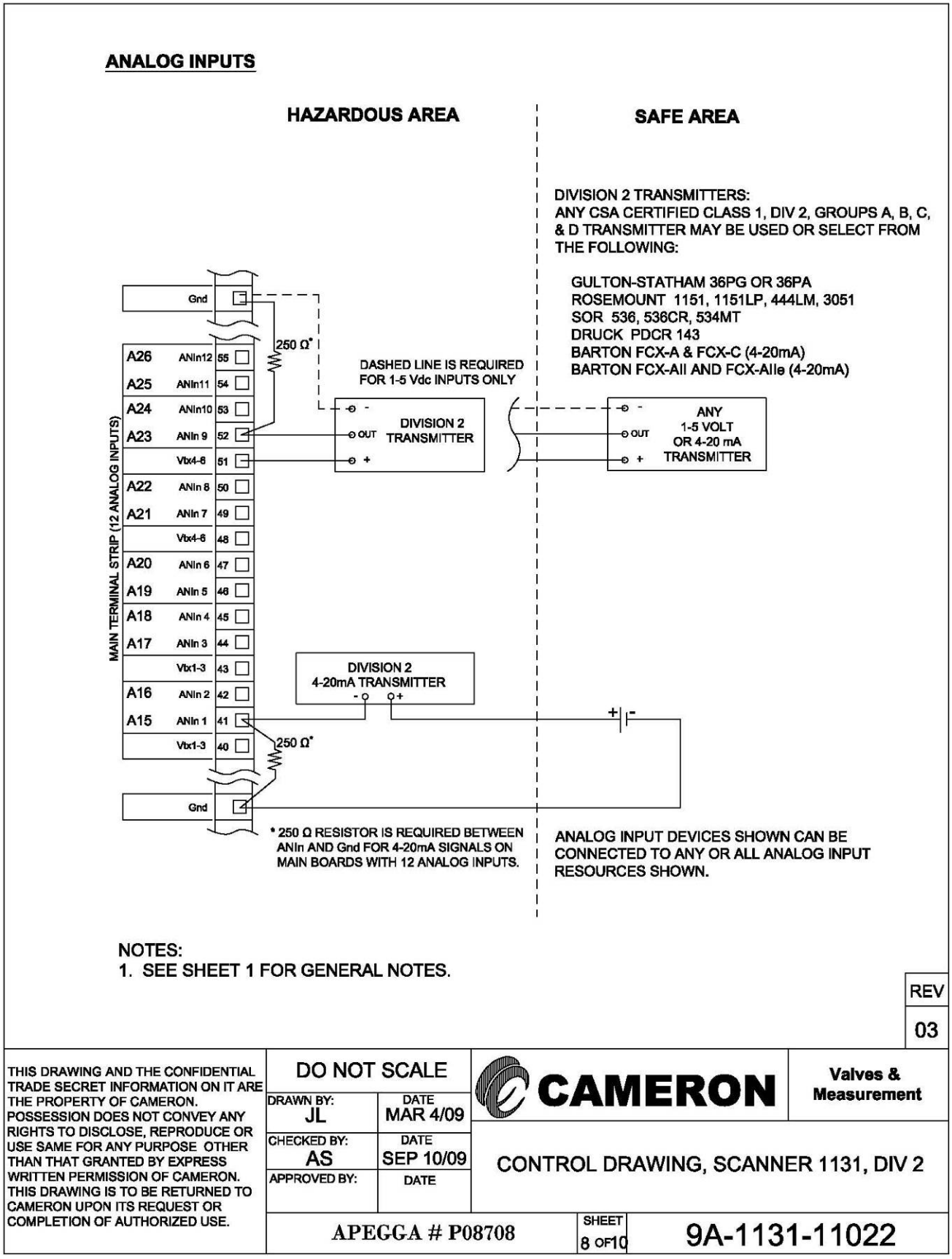
Drawing 16: Status/Pulse Outputs (Div. 2 or Zone 2)



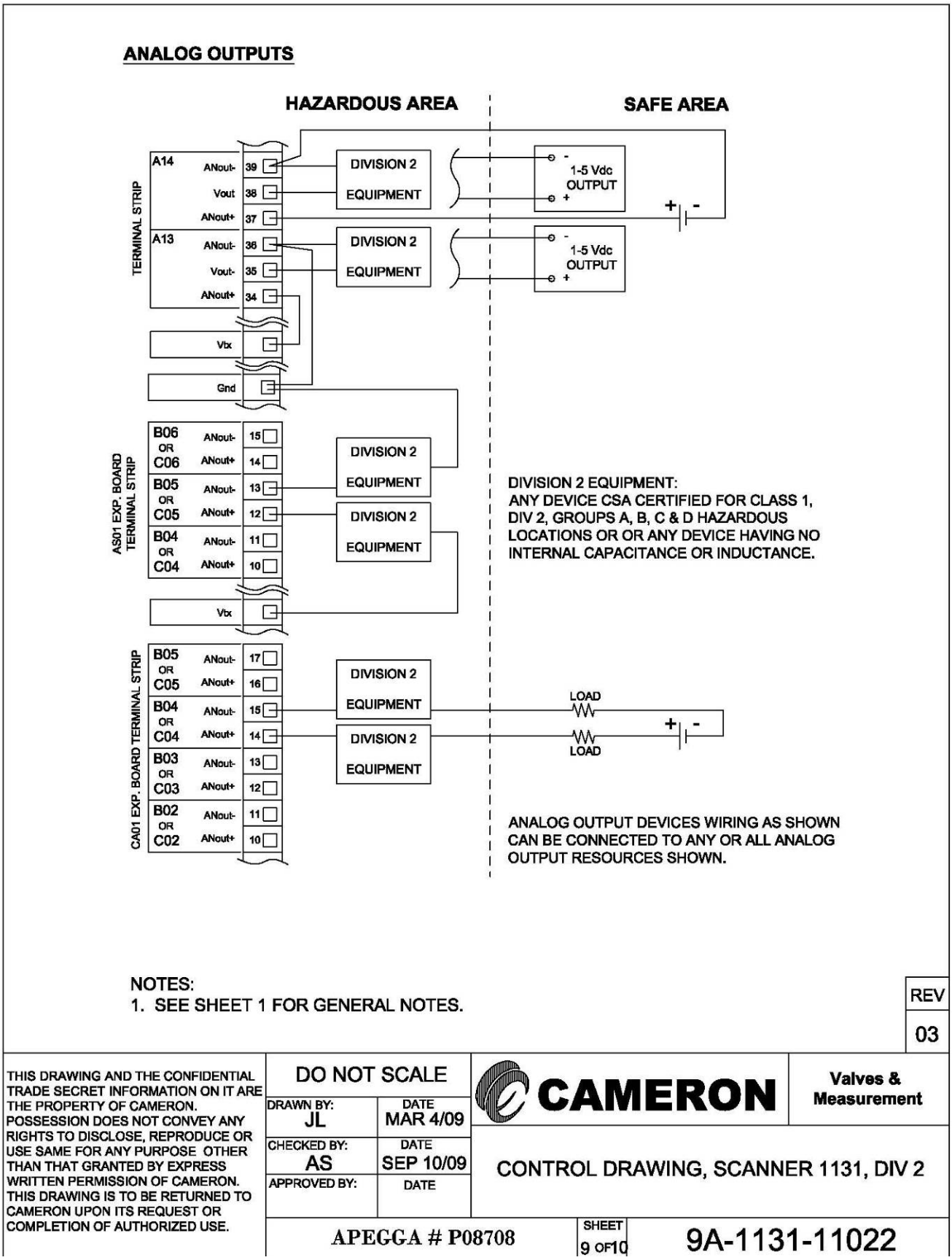
Drawing 17: Pulse/RTD Inputs (Div. 2 or Zone 2)



Drawing 18: Six Analog Inputs (Div. 2 or Zone 2)

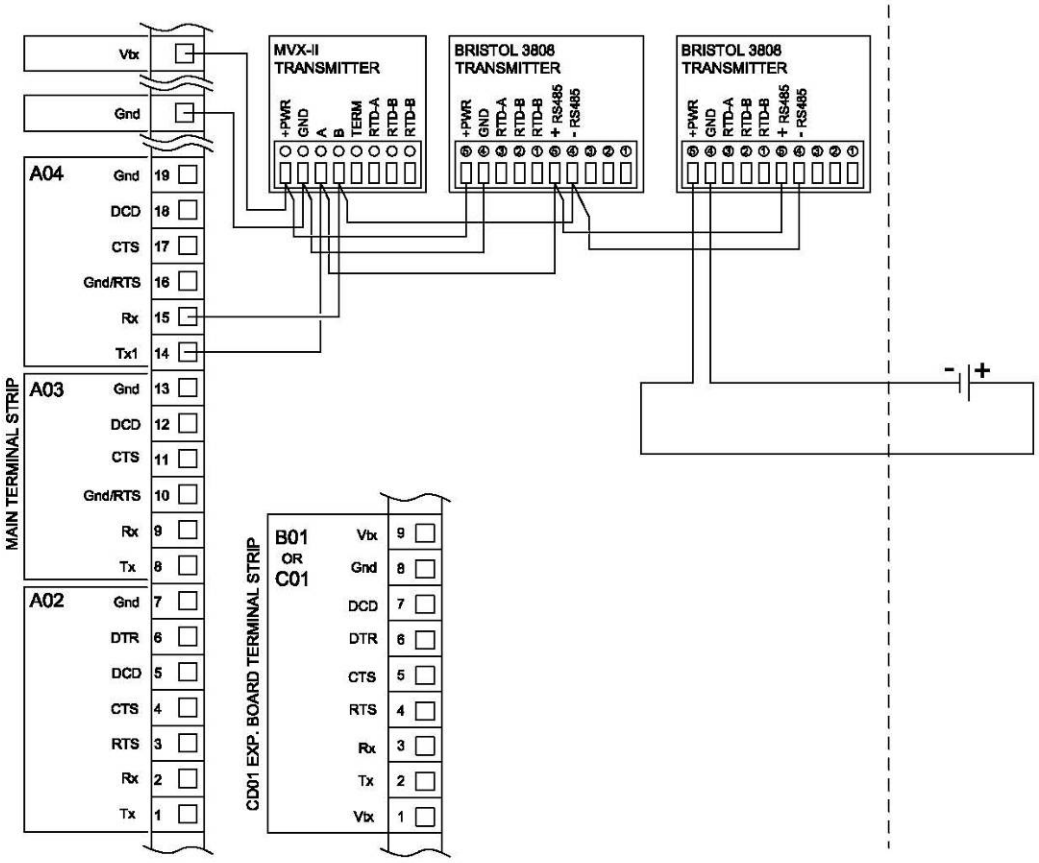


Drawing 19: Twelve Analog Inputs (Div. 2 or Zone 2)



Drawing 20: Analog Outputs (Div. 2 or Zone 2)

MVT INPUTS



NOTES:

1. SEE SHEET 1 FOR GENERAL NOTES.
2. FOR BATTERY POWERED SCANNER 1131 APPLICATIONS, THE TRANSMITTER POWER SUPPLY (Vbx) IS A SOFTWARE CONTROLLED (ON/OFF DURATION) 9 TO 11 Vdc SUPPLY LIMITED TO 15 mA MAXIMUM. EXTERNAL POWER MAY ALSO BE USED.
3. A MAXIMUM OF TEN MVX OR BRISTOL 3808 TRANSMITTERS CAN BE CONNECTED TO ANY OR ALL SERIAL PORT RESOURCES SHOWN.

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CONTROL DRAWING, SCANNER 1131, DIV 2

APEGGA # P08708 | SHEET 10 OF 10 | 9A-1131-11022

Drawing 21: MVX Inputs (Div. 2 or Zone 2)

MEASUREMENT SYSTEMS

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