sensia
Rockwell Automation + Schlumberger

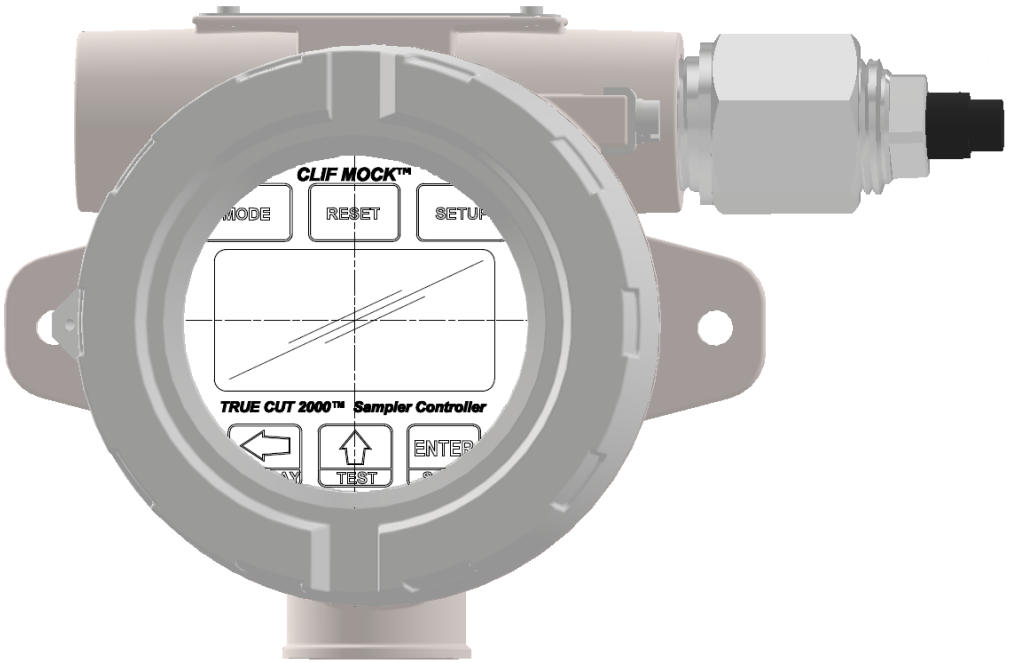
+ MEASUREMENT

CLIF MOCK™

+ True Cut 2000 Sampler Controller

Installation, Operation & Maintenance Manual

MODEL: TC2000



INTELLIGENT ACTION

Manual No. 9A-70165002, Rev. 02

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Important Safety Information

Terms Used in This Manual

Caution	**Caution, risk of electric shock**
Attention	**Attention, risque d'électrocution**

WARNING	**A warning identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.**
AVERTISSEMENT	**Un avertissement identifie des informations sur des pratiques ou des circonstances pouvant entraîner des blessures corporelles ou la mort, des dommages matériels ou des pertes économiques.**

Caution	Caution statements Indicate actions or procedures which, if not performed correctly, may lead to personal injury or incorrect function of the instrument or connected equipment.
Attention	Indiquez les actions ou les procédures qui, si elles ne sont pas effectuées correctement, peuvent entraîner des blessures ou un mauvais fonctionnement de l'instrument ou de l'équipement connecté.

Note	Indicates additional information about specific conditions or circumstances that may affect instrument operation.
Remarque	Indique des informations supplémentaires sur des conditions ou des circonstances spécifiques pouvant affecter le fonctionnement de l'instrument.

REVISION HISTORY

REVISION:	DESCRIPTION OF CHANGE:	ISSUER:	APPROVER:	DATE:
1	Initial Release	AK	TMM	June 2011
2	Update Electronics Package	AK	TMM	September 2020

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GENERAL

WARNING!

To avoid the risk of electric shock and fire, the following safety instructions must be observed and the guidelines followed.

The specifications must not be exceeded, and the device must only be applied as described in the following.

Prior to the installation and commissioning of the unit, the installation guide must be examined carefully.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

GENERAL

AVERTISSEMENT!

Pour éviter tout risque de choc électrique et d'incendie, les consignes de sécurité de ce manuel doivent être observées, et les instructions suivies.

Les spécifications ne doivent pas être dépassées, et l'unité ne doit être appliquée que comme décrit dans le texte suivant.

Ce manuel doit être examiné avec soin, avant l'installation et la mise en service de l'unité.

Si l'équipement est utilisé d'une manière non spécifiée par le fabricant, la protection assurée par l'équipement peut être altérée.

INSTALLATION

WARNING!

Installation may only be carried out by electrically skilled and instructed personnel in accordance with national legislation, including the relevant standards.

All technical data on the instrument is to be observed.

Changes to the design and modifications to the equipment are not permitted.

The equipment shall only be operated as intended and only in undamaged and perfect condition.

Sufficient segregation must exist between different cables and wires carrying different types of signal or power and all other circuits.

All wires must be terminated, complete with crimping lugs. Unused cores should be terminated to the earth bus bar.

INSTALLATION

AVERTISSEMENT!

L’installation ne peut être effectuée que par un électricien qualifié, conformément à la législation nationale, y compris les normes pertinentes.

Toutes les données techniques sur l'instrument doivent être observées.

Modifications de l'équipement ne sont pas autorisés.

L'équipement ne doit être utilisé comme prévu par le fabriquant et uniquement si il est en parfait état.

Une séparation suffisante doit exister entre les différents câbles et les fils transportant différents types de signaux ou de puissance et tous les autres circuits.

Tous les fils doivent être terminés, avec pattes de sertissage. Les noyaux non-utilisés doivent être terminés au jeu de barres de la terre.

Section 1: Introduction

DESCRIPTION

The Clif Mock True Cut 2000 Sampler Controller, see Figure 1, is an electronic controller that can be used to control any pneumatic device. When paired with a liquid/gas sample pump, the device is ideal for sampling liquid or gas flow streams.

The controller can be configured to sample as time proportional or flow proportional. This design allows external pacing devices such as turbines meters to control the sampling frequency.

The controller consists of an explosion proof enclosure with a window for viewing a dual LCD and a six-key keypad, press control switch and electronic circuitry, see Figure 1.

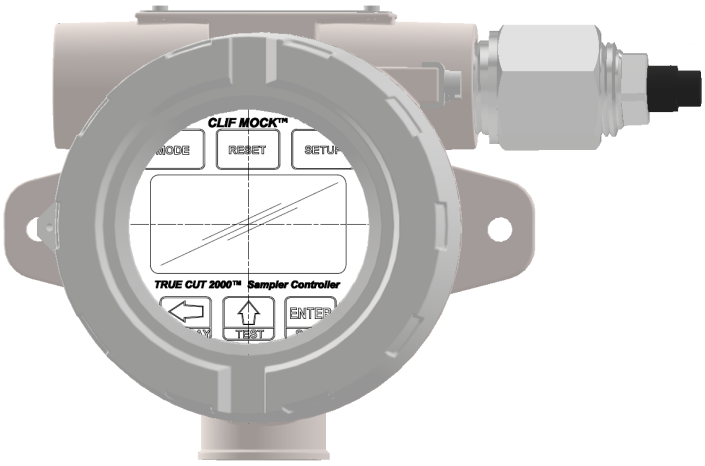

Figure 1: True Cut 2000 Sampler Controller

Section 2: True Cut 2000 Sampler Controller Components and Specifications

DISPLAY

Dual readouts in the front panel display provide a real-time sample count during operation and guide users through configurable settings during device setup. In addition, a user can initiate a scrolling display of performance status indicators and total volumes on demand during normal operation. Run time, percentage of sample job completion, flow rate, total volume, grand volume, system voltage, sampler status, firmware version, and sample count are recorded by the controller and available for display. See Section 4, for details.

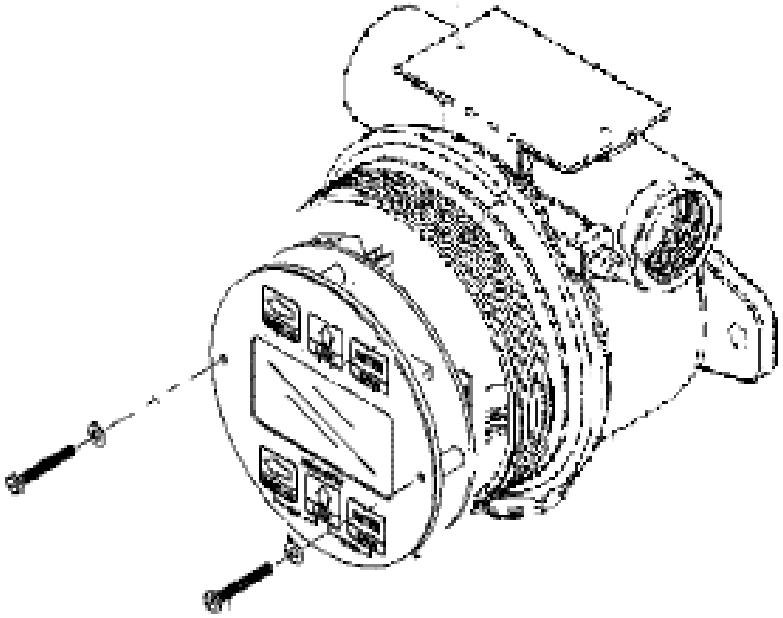

Figure 2: True Cut 2000 Sampler Controller, internal view

POWER SUPPLY

The True Cut 2000 Sampler Controller supports external DC power input supply. An external 6 to 30V DC power supply with a minimum of 65mA can be used to power the controller circuit board.

PRODUCT IDENTIFICATION

A serial tag mounted on top of the enclosure identifies the product by its part number and serial number, see Figure 3. The current model of serial tag reflects Scanner 2000 microEFM, under Model it will show either TC2000 (Electronics Controller) or LGS-2000 (Sampling System).

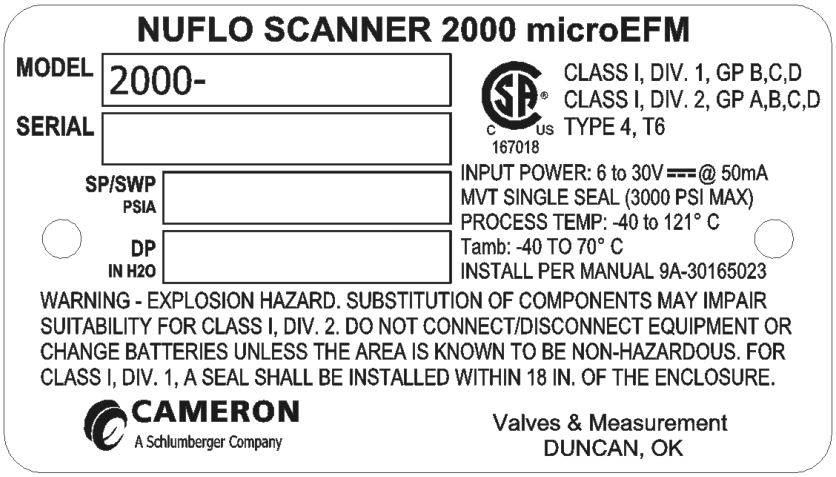

Figure 3: Serial Tag

SPECIFICATION

Table 1: TC2000 Sampler Controller

Enclosure	Explosion Proof, Type 4 enclosure				
Keypad	6-Key membrane switch, Password-protected security available				
Switch	Explosion Proof external Momentary Control Switch				
Power Supply	6-30V DC external power supply				
Operating Environment	True Cut 2000 Sampler Controller: -40°C to 70°C (-40°F to 158°F)				
	0 to 90% non-condensing relative humidity				
	LCD contrast is reduced below -30°C (-22°F)				
Turbine Meter Input	Configurable sensitivity adjustment (20 mV to 200 mV, peak to peak)				
	Frequency range: 0 to 5000 Hz				
	Continuous 50/50 duty cycle				
	Programmable K-factor				
	Input amplitude: 20 mV to 3000 mV, peak to peak				
	Turbine Setting	Input Sensitivity			
		0 – 1000 Hz	1000 – 2000 Hz	2000 – 3500 Hz	3500 - 5000 Hz
	Low (20 mV)	20 mVpp	25 mVpp	50 mVpp	50 mVpp
	Med (50 mV)	50 mVpp	70 mVpp	110 mVpp	140 mVpp
	High (100 mV)	100 mVpp	150 mVpp	250 mVpp	350 mVpp
	Highest (200 mV)	200 mVpp	380 mVpp	620 mVpp	850 mVpp
LCD Display	8-digit top readout of values (7-segment characters)				
	6-digit bottom readout of scrolling parameters and associated engineering units (11-segment characters for easy-to-read prompts) 0.3” character height				
	Configurable scan parameters and duration				
	8-digit top readout of values (7-segment characters)				
Digital Output, Solid State Relay	Rated 30V DC, 60mA max.				

Sampling Methods (Time)	Batch Sampling (controller calculates the frequency of samples required to fill the bottle in a specified time)
	Time Sampling (controller collects samples at user-configured frequency until specified number of samples is collected)
	Continuous Time Sampling (controller collects samples at user-configured frequency until sampling period is manually terminated)
Sampling Methods (Volume)	Turbine Input (controller collects samples to deliver specified volume, based on turbine input frequency settings)
Volume Units	GAL, BBL, M3, LIT, CF, and NONE
Rate Units	/SEC, /MIN, /HR, and /DAY
Security	Two security levels with password protection
Communications	2 RS-485 communication ports (RTU Modbus®)
Safety Approval	True Cut 2000 Sampler Controller Approved by CSA for US and Canada Class I, Division 1, Groups B, C and D (explosion-proof) Class I, Division 2, Groups A, B, C and D (non-sparking) Type 4 enclosure T6 temperature class

Section 3: Installation

GENERAL INFORMATION

The True Cut 2000 Sampler Controller is typically installed after the sample probe and flowmeter are installed in a pipeline.

For sampling liquid or gas, the controller should be installed with a sample pump, a sample probe, a pressure regulator, a flowmeter, and a receiver. In liquid applications, hazardous gas applications, and low-pressure gas applications, an external air supply is also required.

Note	This manual describes the installation of the True Cut 2000 Sampler Controller. For LGS-2000 Sampling System, refer to the LGS-2000 Sampling System User Manual, Part Number 9A-70165003 for additional details.

MOUNTING OPTIONS

The controller is mounted on the backplate of LGS-2000 system where the system can be direct mounted or remote mounted. Refer to LGS-2000 Sampling System User Manual for details. True Cut 2000 Sampler Controller can be mounted remotely using the optional remote mount kit, see Figure 2.1 below.

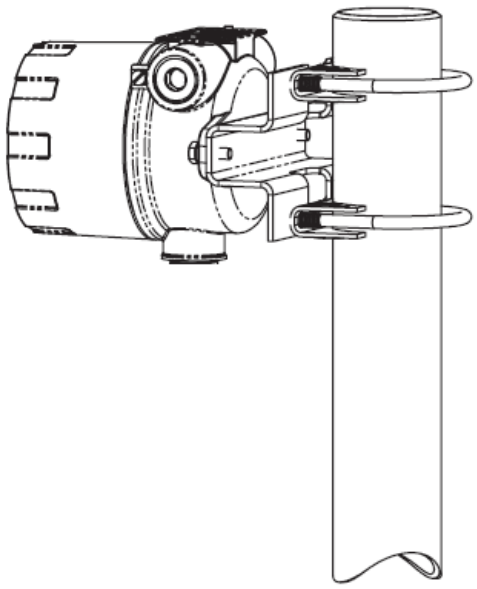

Figure 4: Remote Mount Option

HAZARDOUS AREA INSTALLATIONS

CLASS I, DIVISION 1 (CSA) INSTALLATIONS

True Cut 2000 is CSA-certified as explosion-proof for Class I, Division 1, Groups B, C and D hazardous location when sold individually.

Wiring Precautions

Caution	All signal cable from other devices and power must be installed accordance with local wiring practices for area classification. The cable used between the True Cut 2000 and other devices must be either armored MC-HL type cable or standard cable routed through conduit. If standard cable is used, a conduit seal must be installed within 18 inches from the True Cut 2000.

Note	All Conduit Seal Compound is to be poured during the field installation phase.

CLASS I, DIVISION 2 (CSA) INSTALLATIONS

True Cut 2000 is certified for Class I, Division 2, Groups B, C and D hazardous locations.

Wiring Precautions

Caution	All field wiring must conform to the National Electrical Code, NFPA 70, Article 501-4(b) for installations within the United States or the Canadian Electric Code for installations within Canada. Local wiring ordinances may also apply. All field wiring must be rated for temperature of 90 degC or higher and have wire range of 22 to 14 AWG. Terminal block screws must be tightened to a minimum torque of 5 to 7 in-lbs. to secure the wiring within the terminal block. Only personnel who are experienced with field wiring should perform these procedures.

FIELD WIRING

WARNING	**Do not connect/ disconnect equipment unless the area is known to be non-hazardous. True Cut 2000 poses no hazard when opened in a safe area.**

To wire the True Cut 2000 for operation, open the lid of the enclosure to access the circuit board. Complete the following field connections, referencing Figure 5 for terminal block locations.

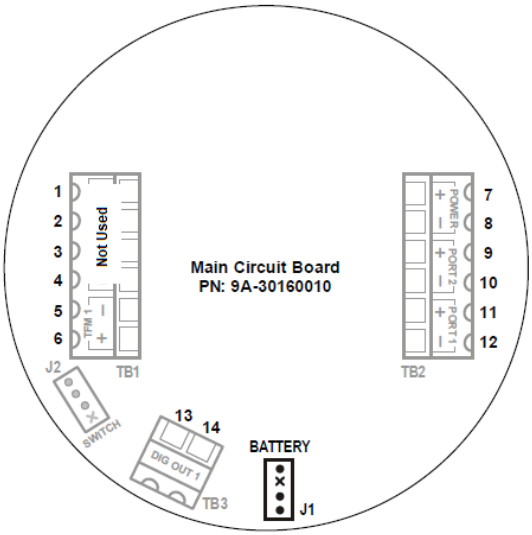

Figure 5: True Cut 2000 circuit board terminal block layout

1. Unscrew the cover of the enclosure counter-clockwise until it separates from the main body of the enclosure.

2. Using a small standard blade screwdriver, remove the two #4-40 x 7/8-in. screws located to the right and left side of the display.

3. Lift the display/ keypad assembly from the enclosure, making sure the circuit assembly does not contact the enclosure.

4. Connect external power wiring to terminal block TB2, follow the below section of External DC Power Supply. Refer to Grounding Procedure, for proper grounding practices.

5. Connect Turbine Input wiring to terminal block TB1, follow the below section of Turbine Input.

6. Connect any communication devices wiring to terminal block TB1, follow the below section of Communication.

7. Place the circuit assembly over the standoffs and fasten with two #4-40 x 7/8-in. screws ensuing that all connector wiring is inside the enclosure and in no position where it may be damaged when the enclosure cover is replaced.

8. Replace the enclosure cover by threading it onto the enclosure in a clockwise direction.

GROUNDING PROCEDURES

To power the True Cut 2000 Sampler Controller with an external DC supply, route the ground conductor through a conduit opening in the top of the True Cut 2000 enclosure with the power conductors and connect it to the ground screw inside the enclosure (note the round sticker that marks this location).

If national or local electrical codes required the enclosure to be grounded, a protective earth grounding conductor may be required. To install a protective earth ground, connect an earth ground conductor to the stainless ground lug near the top of the True Cut 2000 enclosure, or if LGS-2000 system is installed, the earth ground conductor may be connected to the ground lug at the bottom of the system mounting plate. Connect the other end of the ground conductor to a ground rod or other suitable system earth ground. The ground lugs will accept wire sizes from 14 AWG solid conductor to 4 AWG stranded conductor.

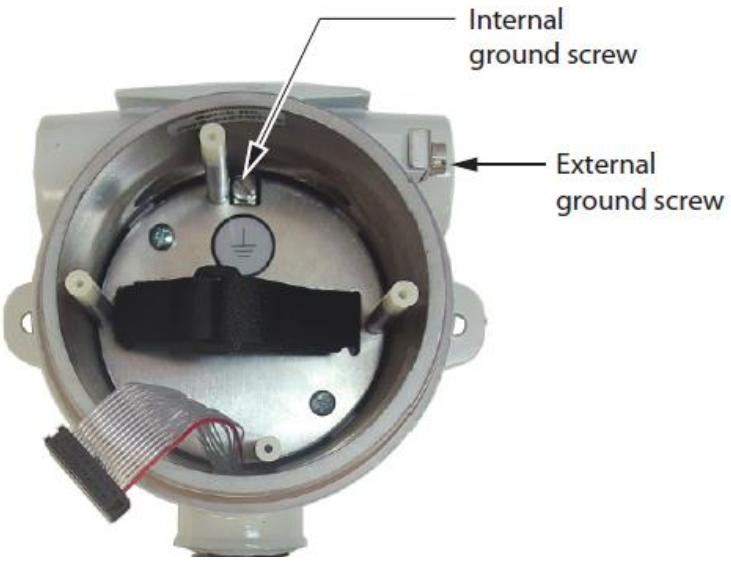

Figure 6: Internal ground screw location

EXTERNAL DC POWER SUPPLY

The True Cut 2000 Sampler Controller can be connected to a customer-supplied 6-30V DC power supply by a two-conductor cable. If the controller is installed in a hazardous area, follow the instruction under the Hazardous Area Installations Instruction.

The external power supply must be an approved SELV source, insulated from the AC main by double/ reinforced insulation per CSA C22.2 No. 61010-1-04/ UL 61010-1 – 2nd Edition.

Note	In all applications using an external power supply, a switch or circuit breaker must be included in the safe area external power supply installation within easy reach of the operator. The switch or circuit breaker must be marked as the “disconnect” for the safe area external power supply.

Note	If the main circuit board is marked with a revision level of 02 or older (revision 01, C, B or A), a Zener diode (Part No. 1.5KE33CA) must be installed for CE approval. The Zener diode is not required for revision 03 and newer circuit board.

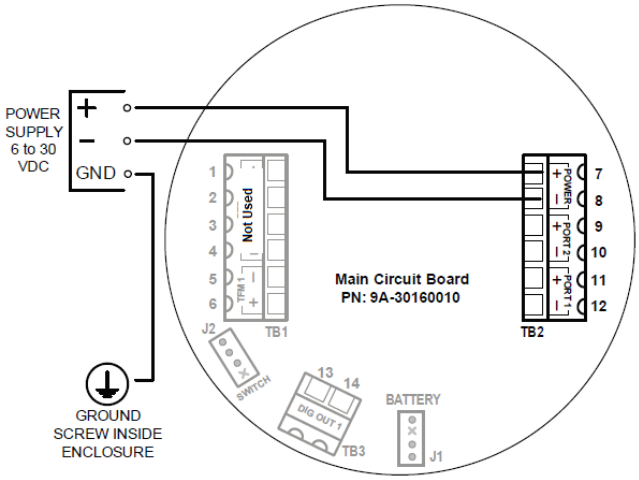

Figure 7: External DC Power wiring diagram

COMMUNICATIONS

Two RS-485 communication ports (COM1 and COM2) are available for use with any device that is capable of reading Modbus data.

Communications connections are not required for basic operation of the controller.

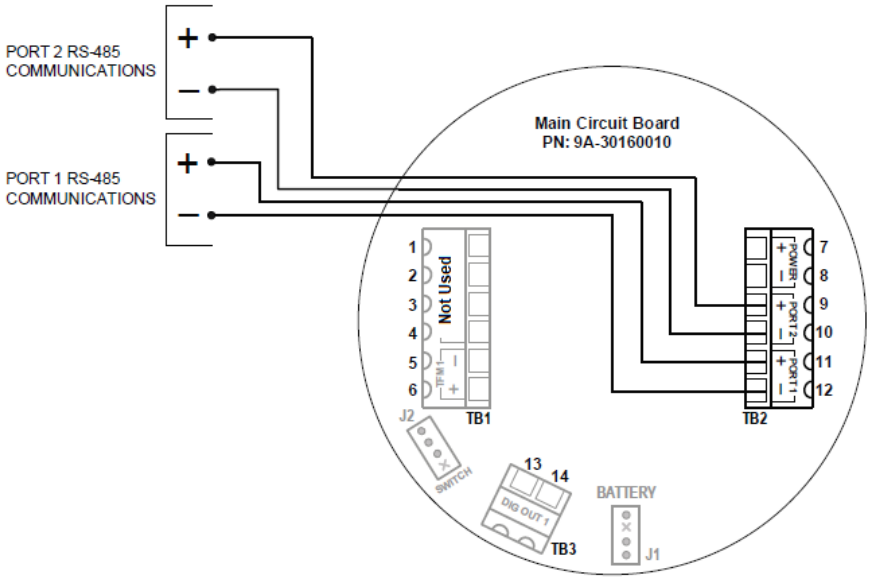

Figure 8: RS-485 communications wiring diagram

TURBINE INPUT

The flowmeter input can be provided by the magnetic pickup of a turbine flowmeter. This input enables the True Cut 2000 to calculate and display flow rates and accumulated totals. The controller can detect a magnetic pickup signal in the range of 20 mV to 3000 mV, peak to peak. Only turbine meters that meet the required entity parameters may be used with this input.

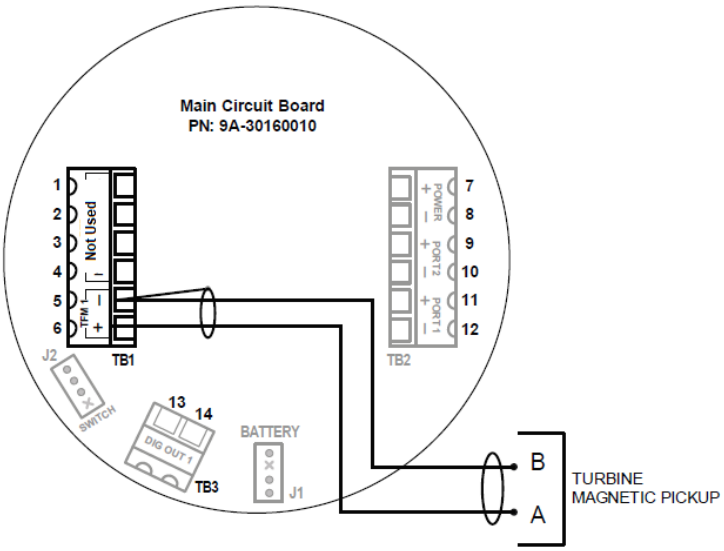

Figure 9: Turbine flowmeter input wiring diagram

DIGITAL OUTPUT (SOLID STATE RELAY)

Digital Output is used to drive the external low power solenoid based on the True Cut 2000 Sampler Controller configuration.

The rating of the Digital Output circuit is 30V DC at 60mA max.

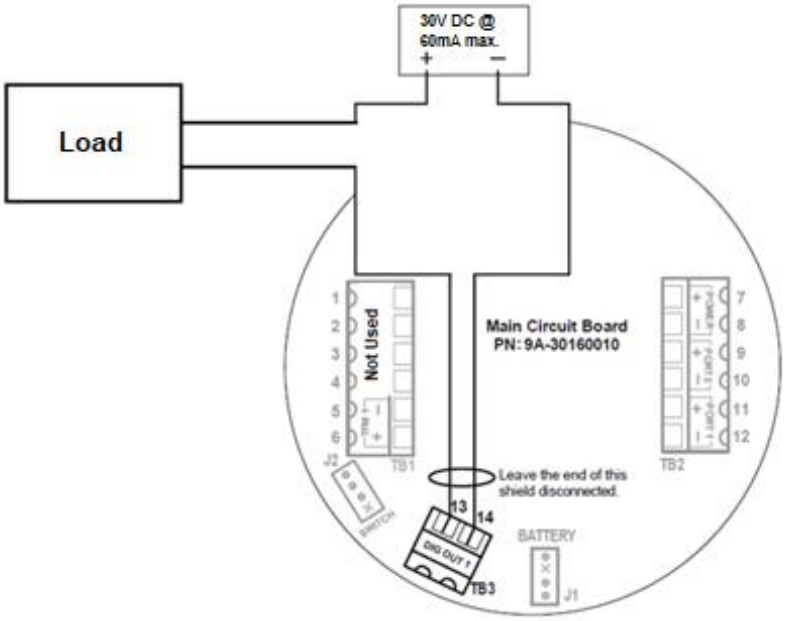

Figure 10: Digital Output wiring diagram, Solid State Relay with 30V DC @60mA max. rating

Note	Before operating the controller for the first time, carefully review the configuration instruction of the controller using the keypad on the overlay.

Section 4: Operating the Controller

FRONT PANEL

The front panel of the controller contains a Liquid Crystal Display (LCD) with a dual readout and a 6-button keypad for configuring the controller and retrieving data. During operation, the LCD displays the sample count for the current sampling period, as shown in Figure 11.

From the front keypad, the operator can change the operating mode, stop a sampling period, start a sampling period, change the sampling configuration settings, initiate a test of the sampling process, and display performance and job status indicators on demand.

This section describes each of these functions except for changing configuration settings. See Section 5, for configuration instructions.

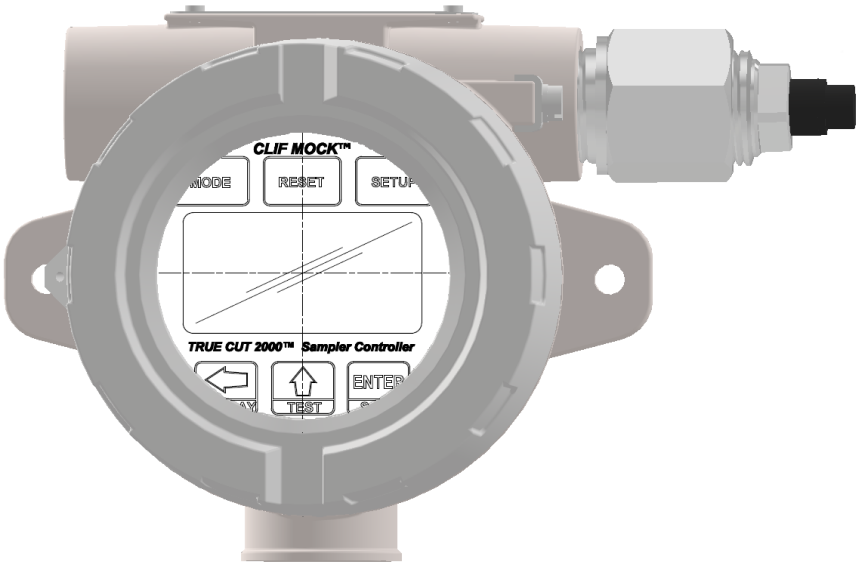

Figure 11: Liquid Crystal display and keypad with the overlay

KEYPAD OVERVIEW

Before programming or operating the sampler for the first time, review this section to familiarize yourself with the functions of each key.

- MODE—allows the operator to manually control the start and stop of a sampling period.
- RESET—starts a new sampling period using the settings last configured. This function is enabled only when the controller is in “Stop” mode.
- SAMPLE SETUP—provides access to configurable settings for controlling the sampling process,see section 5 for step-by-step configuration instructions.
- LEFT ARROW/ DISPLAY—during normal operation, initiates the scrolling display of status parameters and volumes, see Table 1 for details; during configuration, allows user to select a digit to be changed
- UP ARROW/ TEST—during normal operation, initiates a test of the sampling process; during configuration, increments the value of a selected digit.
- ENTER/SAVE—during configuration, saves each setting entered and advances the display to the next required configurable parameter.

- External Reset Control Switch—provides 3 different functions based on the hold time.
    - 0.3 second—scroll through next parameter on display
    - 5.0 seconds—one button quick RESET and START sampling function if the Sampler Controller is in Stop or Idle mode
    - 10 seconds—if the system is running, it will issue a STOP Command; if the system is in STOP mode, it will resume running

COMMON KEYPAD FUNCTIONS

The following information explains how to perform some common tasks with the controller keypad. For step by step instructions for configuring a sampling job, see Section 5.

STOP A SAMPLING PERIOD

To terminate a sampling period, press MODE and press UP ARROW/ TEST to navigate to “Stop” mode. Then press ENTER.

START A SAMPLING PERIOD

To initiate a new sampling period, press MODE and press UP ARROW/ TEST to navigate to “Start” mode. Then press ENTER.

Alternatively, if the controller is in “Stop” mode, press RESET to start a new sampling period using the settings last configured. Pressing RESET automatically changes the mode to “Start.” (If the controller is set to a mode other than “Stop” before pressing RESET, a new sampling period will not be created. In this case, RESET will have no effect on the sampling job.)

PAUSE AND RESUME SAMPLING WITHOUT STARTING A NEW SAMPLING PERIOD

To resume sampling after putting the controller in “Stop” mode without zeroing the sample count, press MODE, press UP ARROW/ TEST to select “Continue” and press ENTER. This is ideal for pausing the sampling process just long enough to change the frequency or volume setting (for example, to expedite completion of the sampling period).

DISPLAY STATUS INDICATORS ON DEMAND

During normal operation, press UP ARROW/ TEST to initiate a scrolling display of status parameters and volumes, see Table 1 for details. After several seconds, the display will revert to the normal operating screen.

TEST THE CONTROLLER

During normal operation, press UP ARROW/TEST to initiate a test of the sampling configuration.

ON-DEMAND DISPLAY OF STATUS INDICATORS AND VOLUMES

During normal operation, the operator can initiate a scrolling display of performance and job status indicators by pressing LEFT ARROW/ DISPLAY. The parameters displayed can vary, depending on the type of sampling programmed. Table 1 lists all supported indicators, and indicates which parameters are available for each sampling configuration. The last two columns of the table show the content of top and bottom readouts associated with each parameter.

Table 1: Status Indicators

Indicator	Time/ Batch	Volume: TFM	Continuous	Test	Text Displayed in Readouts

RUN TIME	Yes	Yes	Yes	Yes	TOP BOTTOM	0.000 RUN TIME - DAYS
PERCENT DONE	Yes	Yes	No	No	TOP BOTTOM	0.00 PERCENT DONE
FLOW RATE	No	Yes	No	No	TOP BOTTOM	0.00 (GAL) FLOW RATE (/SEC)
TOTAL VOLUME	No	Yes	No	No	TOP BOTTOM	0.000 (GAL) TOTAL VOLUME
GRAND TOTAL VOLUME	No	Yes	No	No	TOP BOTTOM	0.00 (GAL) GRAND TOTAL
SYSTEM VOLTAGE	Yes	Yes	Yes	Yes	TOP BOTTOM	6.656 SYSTEM VOLTAGE
SAMPLER STATUS	Yes	Yes	Yes	Yes	TOP BOTTOM	RUNNING SAMPLER STATUS
FIRMWARE VERSION	Yes	Yes	Yes	Yes	TOP BOTTOM	3.00 TRUE CUT 2000
SAMPLES TAKEN	Yes	Yes	Yes	Yes	TOP BOTTOM	0 SAMPLE TAKEN

RUN TIME

Run Time displays the length of time (number of days) the sampler has been in operation during the existing sampling period. The run time value is zeroed each time a new sampling period is started.

PERCENT DONE

Percent Done displays the percentage of a sampling job that is completed at any point in time. This indicator is not available for Continuous Time sampling since the total samples required is not entered or calculated.

FLOW RATE

Flow Rate displays the rate of flow sensed by the input device based on the K-factor entered. The controller displays the flow rate in terms of flow per second, per minute, per hour or per day.

TOTAL VOLUME

Total Volume is the volume of pipe flow sensed by the input device (TFM frequency input) during a volume-based sampling period. The controller calculates and displays pipe flow volume totals in gallons, barrels, cubic meters, litres, or standard cubic feet. If a different unit is required, a “none” option is also available in the controller. Volume is updated once per second. Both volume per sampling period (total volume) and total accumulated volume (grand total volume) are stored in the controller.

Total volume is cleared each time a new sampling period is started.

GRAND TOTAL VOLUME

Grand Total Volume is the total accumulated volume of pipe flow. Unlike total volume, which is zeroed each time a new sampling period begins; the grand total volume is zeroed only when performing a manual reset.

SYSTEM VOLTAGE

System Voltage displays the DC voltage generated by either the battery or an external power supply after power is regulated internally.

SAMPLER STATUS

Sampler Status indicates the status of sampler operation. When the sampler is in operation (controller is placed in “Start” or “Continue” mode), the status will display as “Running.” When performing a test of the sampler (UP ARROW/ TEST), status will display as “Test.” When sampling is manually terminated (controller

placed in “Stop” mode), status will display as “Stop.” When a sample period has ended, status will display as “Done.”

FIRMWARE VERSION

It may be helpful to confirm the firmware version if a question arises about the operation of the device. Over time, multiple firmware versions may be released with varying functionality.

SAMPLES TAKEN

Samples taken during the current sampling period.

Section 5: Programming the Controller

Before programming the controller, review Section 4, to become familiar with the controller keys and their functions.

Because the keypad is protected beneath the lid of the instrument, the enclosure must be opened to access the keypad. For this reason, it is important to configure these settings before installing it in a hazardous area.

WARNING	**To prevent ignition of hazardous atmospheres, do not remove the cover while circuits are alive. The True Cut 2000 Sampler Controller poses no hazard when opened in a safe area.**

During configuration, the LCD guides the user through menus and settings for customizing the sampling operation. When navigating menus, the top readout identifies available menus, and the bottom readout provides quick tips for navigating menus with the arrow keys. Once a menu is selected, the bottom readout identifies each configurable parameter by name and the top readout displays the current value or setting.

TIME-BASED SAMPLING

Use the following procedures to configure the sampler controller for time-based sampling.

To pause sampling before the sampling period is completed, press **MODE**, press **UP ARROW/ TEST** to change the mode to “Stop” and press **ENTER** to stop the sampling process. Make any changes necessary (for example, a user may wish to change the frequency or volume setting to expedite completion of the job) and press **ENTER**.

To resume sampling without zeroing the sample count, press **MODE**, press **UP ARROW/ TEST** to select “Continue” and press **ENTER**. The sampler will resume operation and the previously saved sample count will begin to increment using the new settings to control the sampling process.

BATCH/ TIME SAMPLING

1. Press **SAMPLE SETUP** and then press **UP ARROW/ TEST** to select “Batch” or “Time.” Press **ENTER**.

    a. If “Batch” is selected, enter the “Sample Period” (number of days allowed for sample collection) by pressing **UP ARROW/ TEST**. Press **ENTER**.
    b. If “Time” is selected, enter the “Sample Frequency” in seconds using the **LEFT ARROW/ DISPLAY** key to select a digit and the **UP ARROW/ TEST** key to change the digit’s value. Values from 1 to 65535 may be entered. Press **ENTER.**

2. Enter the “Bottle Size” by pressing **LEFT ARROW/ DISPLAY** to select a digit and **UP ARROW/ TEST** to change the digit’s value. Values from 25 to 10,000 may be entered. Press **ENTER**. (The value entered can reflect any unit the user desires).

3. Enter the “Sample Size” by pressing **LEFT ARROW/ DISPLAY** to select a digit and **UP ARROW/ TEST** to change the digit’s value. Values from 0.05 to 10 may be entered. Press **ENTER**. (The value entered can reflect any unit the user desires.)

4. Enter the “Pulse Width” in “msec” by pressing **UP ARROW/ TEST** and **LEFT ARROW/ DISPLAY** to change position. Values from 500 to 5000 milli-seconds. Press **ENTER**.

5. Press **RESET** to begin sampling. When the sampling job is completed, the final sample count will be displayed in the top readout and the words “Sampling Done” will appear in the bottom readout.

CONTINUOUS TIME SAMPLING

1. Press **SAMPLE SETUP** and press **UP ARROW/ TEST** to select “Cont.” Press **ENTER**.

2. Enter the “Sample Frequency” in seconds by pressing **UP ARROW/ TEST**. Values from 1 to 65535 may be entered. Press **ENTER**.

3. Enter the “Pulse Width” in “msec” by pressing **UP ARROW/ TEST** and **LEFT ARROW/ DISPLAY** to change position. Values from 500 to 5000 milli-seconds. Press **ENTER**.

4. Press **RESET** to begin sampling. Sampling will continue until the sample period is manually terminated.

Note	The user must MANUALLY terminate the sampling period when continuous time sampling is configured. To minimize the risk for overflow, continuous time sampling is not recommended for use in filling portable receivers. This configuration is typically used when collecting sampled product in tanks or other large storage devices.

VOLUME-BASED SAMPLING

Use the following procedures to configure the sampler controller for volume-based sampling.

To pause sampling before the sampling period is completed, press **MODE**, press **UP ARROW/ TEST** to change the mode to “Stop” and press **ENTER** to stop the sampling process. Make any changes necessary (for example, a user may wish to change the frequency or volume setting to expedite completion of the job) and press **ENTER**.

To resume sampling without zeroing the sample count, press **MODE**, press **UP ARROW/ TEST** to select “Continue” and press **ENTER**. The sampler will resume operation and the previously saved sample count will begin to increment using the new settings to control the sampling process.

VOLUME SAMPLING

1. Press **SAMPLE SETUP** and press **UP ARROW/ TEST** to select “Vol Accu.” Press **ENTER**.

2. For “Input Sensitivity,” press **UP ARROW/ TEST** to select ‘Lo”, “Med”, “Hi” or “Highest.” Press **ENTER.**

3. Enter “K Factor” by pressing **LEFT ARROW/ DISPLAY** to select a digit and **UP ARROW/ TEST** to change the digit’s value. Press **ENTER**.

4. Press **UP ARROW/ TEST** to select flow unit (GAL, BBL, M3, LIT, CF, NONE). Press **ENTER**.

5. Press **UP ARROW/ TEST** to select rate unit (SEC, MIN, HR, DAY). Press **ENTER.**

6. Enter ‘Volume Per Sample” by pressing **LEFT ARROW/ DISPLAY** to select a digit and **UP ARROW/ TEST** to change the digit’s value. Values from 0.05 to 10 may be entered. Press **ENTER**.

7. Select “Bottle Size” by pressing **LEFT ARROW/ DISPLAY** to select a digit and **UP ARROW/ TEST** to change the digit’s value. Values from 25 to 10000 may be entered. Press **ENTER**. (The value entered can reflect any unit the user desires.)

8. Select “Sample Size” by pressing **LEFT ARROW/ DISPLAY** to select a digit and **UP ARROW/ TEST** to change the digit’s value. Values from 0.05 to 10 may be entered. Press **ENTER**. (The value entered can reflect any unit the user desires.)

9. Enter the “Pulse Width” in “msec” by pressing **UP ARROW/ TEST** and **LEFT ARROW/ DISPLAY** to change position. Values from 500 to 5000 milli-seconds. Press **ENTER**.

10. Press **RESET** to begin sampling. When the sampling job is completed, the final sample count will be displayed in the top readout and the words “Sampling Done” will appear in the bottom readout.

SAMPLER TEST

The TEST key on the keypad allows a user to test sampler function by activating the solenoid for a short period. The TEST menu can also be accessed from the SAMPLE SETUP menu.

1. Press **UP ARROW/ TEST**. “Run Test” will appear in the bottom readout. By default, the setting in the top readout is YES.

2. To proceed, press **ENTER**. The “Number of Test Samples” parameter is displayed.

3. Enter the desired number of test samples by pressing **LEFT ARROW/ DISPLAY** to select a digit and **UP ARROW/ TEST** to change the digit’s value. Values from 1 to 20 may be entered. Press **ENTER**.

4. Press **ENTER**. The test should start automatically, and SAMPLES TAKEN should appear on the display. By default, the test function will activate the solenoid every 5 seconds with the “Pulse Width” of 1 second until the sample count equals the configured number of test samples.

5. When the sampling job is completed, the final sample count will be displayed in the top readout and the words “Sampling Done” will appear in the bottom readout.

KEYPAD SECURITY

The True Cut 2000 Sampler Controller supports two levels of keypad security.

The Basic security setting allows an administrator to restrict access to the Sample Setup key to prevent unauthorized users from changing configuration settings.

The Advanced security setting allows an administrator to restrict access to all keys except the **LEFT ARROW/ DISPLAY** key and the **ENTER/ SAVE** key. With this setting enabled, unauthorized users cannot change configuration settings, mode of operation, or start a new sampling period.

Using the steps below, the administrator can disable security (providing full access to the keypad controls to all users), enable basic security, or enable advanced security.

DISABLE SECURITY

1. Press **LEFT ARROW** and **UP ARROW** together to enter “Security” Menu.

2. Select “No” for no security by pressing **UP ARROW/ TEST**. Press **ENTER**.

3. Test to see if all buttons can be accessed.

BASIC SECURITY

1. Press **LEFT ARROW** and **UP ARROW** together to enter “Security” Menu.

2. Select “Basic” by pressing **UP ARROW/ TEST**. Press **ENTER**.

3. Enter “Security Code” by pressing **LEFT ARROW/ DISPLAY** to select a digit and **UP ARROW/ TEST** to change the digit’s value. Press **ENTER**. The default access code is 0000.

    a. Record the new security code for future reference.
    b. To restore access to security settings in the event of a lost access code, see Security Bypass.

4. Press **SAMPLE SETUP**. If it is locked and cannot be accessed, the security control is enabled.

ADVANCED SECURITY

1. Press **LEFT ARROW** and **UP ARROW** together to enter “Security” Menu.

2. Select “Advanced” by pressing **UP ARROW/ TEST**. Press **ENTER**.

3. Enter “Security Code” by pressing **LEFT ARROW/ DISPLAY** to select a four-digit code and **UP ARROW/ TEST** to change the digit’s value. Press **ENTER**. The default access code is 0000.

   a. Record the new security code for future reference.
   b. To restore access to security settings in the event of a lost access code, see Security Bypass.

4. Press each key to test the security control. Only **LEFT ARROW/ DISPLAY** and **ENTER** should be accessible.

ACCESS MENU

COMMUNICATION PORT SETTINGS

1. Press **UP ARROW** and **ENTER** together to enter “Access” Menu.

2. Select "Port 1" slave address by pressing **UP ARROW/ TEST** to change the first digit, use the L**EFT ARROW** to move to left position. Press **ENTER** when done. The default Slave Address is 1.

3. Select "Port 1 Baud Rate" by pressing **UP ARROW/ TEST** to select. Press **ENTER.** The default baud rate is 9600.

4. Select "Port 2" slave address by pressing **UP ARROW/TEST** to change the first digit, use the L**EFT ARROW** to move to left position. Press **ENTER** when done. The default Slave Address is 1.

5. Select "Port 2 Baud Rate" by pressing **UP ARROW/TEST** to select. Press **ENTER.** The default baud rate is 9600.

RESET ALL TOTALS

1. From the above, press **UP ARROW** to select YES or NO to reset all total. Press **ENTER.** The default is selected to be YES.

LOAD FACTORY DEFAULT SETTINGS

1. Press **LEFT ARROW**, **UP ARROW** and **ENTER** all together to enter "Load Default" mode.

2. No further action needed.

SECURITY BYPASS

Have you misplaced your security password? Sensia gives you the ability to restore access quickly and easily with a one-time bypass code.

Note	To obtain a bypass code, you must provide Sensia with a number generated using the following procedure. Before starting this process, make sure you have paper and a pen to record the number that appears on the instrument display. The number will remain on the display only for a few seconds.

To obtain this bypass code, perform the following steps:

1. Record the serial number of your True Cut 2000 instrument (shown on the serial tag attached to the outside of the enclosure). You will be asked for this information later in the procedure.

2. Using the True Cut 2000 keypad, press and hold the **LEFT ARROW** and **ENTER** keys simultaneously. The word “BYPASS” will appear in the bottom display, and a number will appear in the top display.

3. Record this number.

4. Call a Sensia sales representative and provide the number from the display and the serial number of the True Cut 2000 instrument. After verifying your identity, sales representative will provide you with a one-time bypass code.

Enter the bypass code in place of your password at the security code prompt the next time you use the keypad.

Section 6: True Cut 2000 Sampler Controller Spare Parts

WARNING	**EXPLOSION HAZARD – Substitution of components may impair suitability for Class I, Division 1. Use of spare parts other than those identified by Sensia LLC. voids hazardous area certification. Sensia bears no legal responsibility for the performance of a product that has been serviced or repaired with parts that are not authorized by Sensia.**

Table 2: Spare Parts

Part Number	***Description***
9A-30160010ROHS	Circuit Board Assembly
2295629-01	True Cut 2000 Switchplate Assembly
9A-30054001	Explosion-proof Momentary Control Switch, Fits ¾-in. Female NPT
9A-100002605	Desiccant, Humidisorb, Self-Regenerate, 2-in. x 2-in. Packet with Adhesive

Table 3: Optional Accessories

Part Number	***Description***
9A-30028004	Kit, Pole Mount, Plated Steel
9A-30028005	Kit, Pole Mount, Stainless Steel

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Appendix A: **Communications Protocol**

Firmware Version: 3.00

Register Table Version: 7

INTRODUCTION

The communications protocol for the True Cut 2000 is in accordance with Modicon, Inc. RTU Mode Modbus® as described in Modicon Modbus Protocol Reference Guide, PI-MBUS-300 Rev. J, June 1996. All registers are implemented as 4X or holding registers. Reading of registers is implemented via function code 03H (Read Holding Registers). Writing to registers is implemented via function code 10H (Preset Multiple Registers).

SUPPORTED COMMANDS

The Modbus® functions supported by the True Cut 2000 are as follows:

Function Code (Hex)	***Description***
03	Read Holding Registers
10	Preset Multiple Registers

For the read holding and pre-set multiple registers, the instrument supports the full 250 bytes of data in a message. This corresponds to 125 registers in 16-bit holding register size.

DATA TYPES

Various data types are implemented in the True Cut 2000. The following table lists the formats and the numbers of bytes and registers associated with each type

Data Type	***Byte Count***	***Register Count***
Floating Point (FP)	4	2
Unsigned Word (U16)	2	1

The word ordering for multiple register data types, such as floating-point numbers or long integers, is for the most significant word to appear first in the message.

The Unsigned Word (U16) type is used for 16-bit integers and fits into one register.

REGISTERS

Each register has an Access type: read-only or read-write, as described below.

Access Type	***Description***
Read Only (RO)	Register can only be read
Read/Write (R/W)	Register can be read and written

The registers are grouped into Modbus® map blocks according to function. The True Cut 2000 contains the following map functions.

Map	***Starting Register***
Communications Configuration	1100
True Cut 2000 Configuration	1700
Holding Registers	8762

Note	All registers cited in this document refer to the address of the register that appears in the actual Modbus® message. For example, register 8000 has an address of 0x1F40 hexa- decimal in the message.

Communications Configuration

Register (Decimal)	***Register (Hex)***	***Description***	***Data Type***	***Access***	***Default***
1100	44C	Port 1 – Port Usage 0 – Slave	U16	R/W	0
1101	44D	Port 1 Slave Address [1 to 65535, excluding 252 and 64764]	U16	R/W	1
1102	44E	Port 1 – Baud Rate 3 – 2400 4 – 4800 5 – 9600 6 – 19200 7 – 38400	U16	R/W	5
1103	44F	Port 1 – Bus Delay mS of delay before transmitting data	U16	R/W	10
1104	450	Port 1 – Bus Timeout mS of delay before resetting communications	U16	R/W	50
1105	451	Port 2 – Port Usage 0 – Slave	U16	R/W	0
1106	452	Port 2 Slave Address [1 to 65535, excluding 252 and 64764]	U16	R/W	1
1107	453	Port 2 – Baud Rate 3 – 2400 4 – 4800 5 – 9600 6 – 19200 7 – 38400	U16	R/W	5
1108	454	Port 2 – Bus Delay mS of delay before transmitting data	U16	R/W	10
1109	455	Port 2 – Bus Timeout mS of delay before resetting communications	U16	R/W	50

True Cut 2000 Configuration

Register (Decimal)	Register (Hex)	Description	Data Type	Access	Default	Min/Max
1700	6A4	1 (Reserved)				—
1701	6A5	Sampler Function Type 0 – Batch 1 – Time 2 – Volume 3 – Continuous 4 – Test	U16	R/W	0 – Batch	—
1702	6A6	Function Mode 0 – Stop 1 – Start 2 – Continue	U16	R/W	0 – Stop	—
1703	6A7	Volume Sampling Type 0 – Lo 1 – Med 2 – High 3 – Highest	U16	R/W	0 – Lo	—
1704	6A8	(Reserved)				—
1705	6A9	(Reserved)				—
1706	6AA	Keypad Security Type 0 – None 1 – Basic 2 – Advanced	U16	R/W	0 – None	—
1707	6AB	(Reserved)				—
1708	6AC	Pulse Width (msec)	U16	R/W	1000	500 / 5000
1709	6AD	Test Sampling Max Count	U16	R/W	10	1 / 20
1710	6AE	Sample Period (Days) 0 – 1 Day 1 – 2 Days 2 – 3 Days 3 – 4 Days 4 – 5 Days 5 – 6 Days 6 – 7 Days 7 – 10 Days 8 – 14 Days 9 – 15 Days 10 – 21 Days 11 – 25 Days 12 – 28 Days 13 – 30 Days 14 – 31 Days	U16	R/W	13 – 30 Days	—
1711	6AF	Sample Frequency (Seconds)	U16	R/W	5	1 / 65535
1712	6B0	Volume Flow Unit (Scale) 0 – No Unit (1.000000000000) 1 – GAL (1.000000000000) 2 – BBL (0.023809523810) 3 – M3 (0.003785411780) 4 – LIT (3.785411784000) 5 – CF (0.133680555560)	U16	R/W	1 – GAL	—
1713	6B1	Volume Flow Rate Unit – Time Base 0 – Second 1 – Minute 2 – Hour 3 – Day	U16	R/W	0 – Sec	—

1714	6B2	Sample Bottle Size	FP	R/W	300.00	25 / 10000
1716	6B4	Sample Grab Size	FP	R/W	0.5	0.05 / 10
1718	6B6	K-Factor	FP	R/W	900.00	—
1720	6B8	Volume Per Sample	FP	R/W	5.00	0.05 / 100
1722	6BA	(Reserved)				—
1724	6BC	(Reserved)				—

Holding Registers

Register (Decimal)	***Register (Hex)***	***Description***	***Data Type***	***Access***
8762	381	Current Sample Count	FP	RO
8764	382	Current Sampling Time (Second)	FP	RO
8766	383	Current Sampling Time (Day)	FP	RO
8768	384	(Reserved)	FP	RO
8770	385	Maximum Sample Per Bottle	FP	RO
8772	386	Sample Bottle Fill Percent	FP	RO
8774	387	Sample Frequency	FP	RO
8776	388	Grand Total Volume	FP	RO
8778	389	Current Total Volume	FP	RO
8780	390	Flow Rate	FP	RO
8782	391	Input Frequency	FP	RO
8784	392	K-Factor	FP	RO
8786	393	Sampler Status 0 – Idle 1 – Running 2 – Test 3 – Stop 4 – Done	FP	RO
8788	394	Test Sample Count	FP	RO

Appendix B: **Publisher Notes**

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