

BULLETIN 344B

INSTALLATION & OPERATION

SiloPatrol®

Inventory Monitoring System

**Installation & Operation Manual
Software Programming Manual**

**HMI Products (6-86XX-X1 Controllers)
RDU Products (6-87XX-61 Controllers)**

Used With or Without Auxiliary Output Enclosures (AOE)

In the event that information contained herein does not completely satisfy your requirements or answer your questions, you may contact Technical Support on our website www.monitortech.com, by telephone at 800-766-6486 (630-365-9403), or by fax at 630-365-5646. If your SMU ever requires service either in or out of warranty, please contact us and obtain an RMA number prior to shipping the unit to us.



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ATTENTION:

USE OF VOLUME & WEIGHT CALCULATIONS

The HMI and **SiloTrack**[™] Inventory Management Software can perform calculations to display the volume and weight of material in each vessel. When utilizing this capability, the HMI or **SiloTrack** software will calculate the volume and weight based upon the distance measurement made by the SMU, the vessel dimensions and the material bulk density entered during setup.

The calculated volume and weight values are effected by variations in actual vessel dimensions, angle of repose, fluctuation in material bulk densities, material flow properties (ratholes, bridging, etc.), vessel inlet/discharge location(s) and location of the sensor on the vessel. The direct distance measurement made by the SMU is from the bottom of the SMU mounting flange to the point on the plumb bob.

Prior to equipment installation, please consult the factory to discuss the application details if the volume/weight calculation are of critical importance.

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INTRODUCTION

We at Monitor Technologies LLC are pleased to provide you this quality instrumentation system. We are confident that you will be pleased with the operation of this product. Please do not hesitate to call the factory for any technical assistance, suggestions, or comments.

HMI (Human Machine Interface) Controllers and RDUs (Remote Display Units) are very similar in design. The primary difference is that the RDU is simply a monitoring device that is not capable of initiating measurements or processing control functions such as relay and analog outputs. Both products require initial programming as described in this manual. Program functions that are not applicable to an RDU are noted at each parameter with **"(INACTIVE IN RDU)."** You may have only one HMI per system, but you may have up to four RDUs if desired.

The HMI continuously monitors the status of each SMU via a multi-dropped RS-485 communication link. Each SMU is uniquely addressed via an on-board selection switch. Communication failures are detected and indicated immediately on the HMI. When prompted by the HMI, either manually from an operator or automatically by the HMI's programmable timebase, the SMU takes a measurement. The latest measurement value is communicated to the HMI. Calculations are performed and made available for viewing on the LCD. Relay outputs and analog 4-20mA outputs are generated based on user-programmable variables then communicated from the HMI to the appropriate Auxiliary Output Enclosure (AOE).

INSTALLATION

2.1 Pre-Installation Considerations

Choosing a Location for HMI and RDU:

- 1) **Environment** - These products are suitable for ordinary locations only. They can be used in either indoor or outdoor environments. Note the temperature limits in the specifications. The back-lit LCD display makes operation possible in low ambient light conditions.
- 2) **Placement** - The hardened communication network used to interconnect the SMUs, HMI, RDU and AOE's permits the ends of the network to be extended as much as 4000ft (1219m). This permits placement of the particular product in the area best suited. For example, the RDU could be mounted at the silo base for operator viewing and the HMI could be mounted in the main control room thereby minimizing installation cost.

2.2 Mechanical Installation

HMI and RDU Mounting: (See Figure 1)

- 1) **Location:** Select a mounting location in accordance with the Pre-Installation Considerations.
- 2) **Preparation:** Open the HMI or RDU cover and locate the four corner mounting locations. These mounting points are located outside of the environmentally protected area of the enclosure. Use the HMI or RDU as a template to mark the locations of the four corner mounting points.
- 3) **Mounting:** Secure the HMI or RDU to the wall with 1/4in (6mm) bolts. **Note:** head size must be smaller than 1/2in (13mm) and the bolts must be at least 1in (25mm) long to reach through enclosure.
- 4) **Accessory Mounting Brackets:** If mounting through the enclosure is undesirable, external mounting brackets can be purchased as an accessory. The brackets can be oriented vertically or horizontally.

2.2 Electrical Installation (See Figure 2)

- 1) **Permanently Connected Equipment** - Disconnecting devices shall be included in the system installation. In installations where multiple circuits are used (i.e. independent circuits for power input, cycle, count, sound and standpipe heater), individual disconnects are required. The disconnects shall be within close proximity of the equipment, accessible to operators, and marked appropriately as the disconnect for the associated circuit. Assure the disconnect ratings are appropriately sized for the circuit protected (See Specifications).
- 2) **Circuit Separation** - Two cable entry locations are provided to aid in maintaining separation of "hazardous live" (typically mains voltages such as 115VAC and 230VAC) and limited circuits (typically control voltages less than 30Vrms or 42.4VDC). However, since the HMI/RDU's single wiring compartment can not absolutely protect against physical contact between multiple circuits, it is required that all wiring have an insulation rating of 300v minimum, and a temperature rating of 176°F (80°C) minimum.
- 3) **Protective Earthing** - Each HMI/RDU is provided with a "protective conductor terminal" \ominus which shall be terminated to the local earth ground potential. This terminal shall be used to eliminate shock hazard in the unlikely event of internal insulation breakdown. Select wire size that can carry in excess of the sum of all circuit's maximum amperage.
- 4) **Power Input** - The HMI/RDU is designed to accept either 115 VAC or 230 VAC (factory set). Verify the intended voltage supply is compatible with the voltage configuration indicated on the electronics and the external nameplate. Connect power as shown to "L1" and "N" being sure to observe polarity. The HMI/RDU features a specific cord connector entry for power suitable for a cable with a diameter of 0.17-0.47in (4.3-11.9mm). The cord connector can be removed leaving a 0.875in (22.2mm) through-hole suitable for 1/2in (M20) fittings.
- 5) **Communications Link** - The HMI/RDU features a cord connector entry for communications suitable for a cable with a diameter of 0.17-0.47in (4.3-11.9mm). The cord connector can be removed leaving a 0.875in (22.2mm) through-hole suitable for 1/2in (M20) conduit fittings. Interconnection of the network is performed by a 2-conductor shielded cable (such as Belden 9322). All products are interconnected in a daisy-chain, multi-drop configuration. Order of connection is not important. Communication networks such as this operate best when the interconnection has only two ends. "T"s should be avoided whenever possible. Observe polarity when making the communication interconnection (D+ and D-). Attach cable shield in terminal provided.

DIMENSIONS ARE SHOWN IN INCHES WITH MILLIMETER EQUIVALENT IN BRACKETS

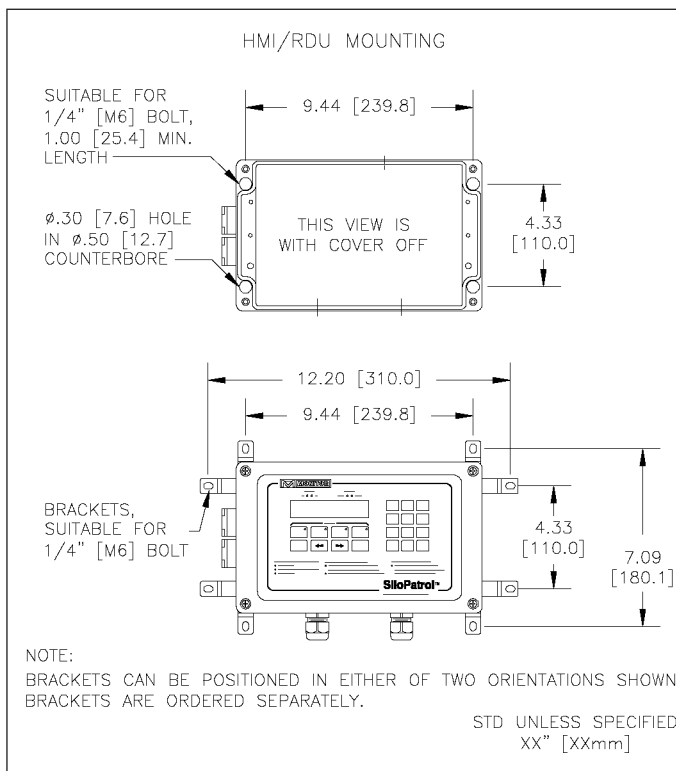


Figure 1

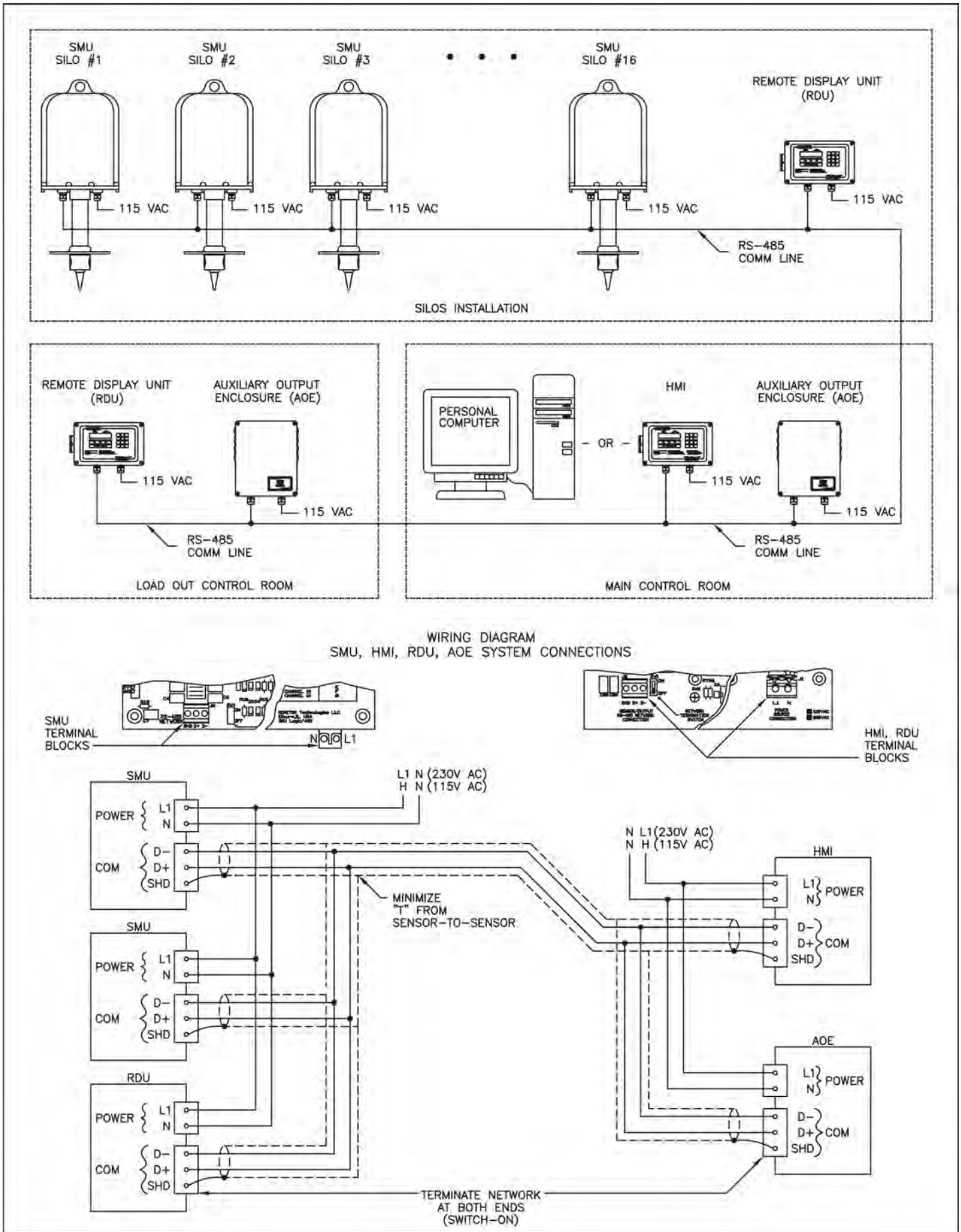


Figure 2

SETUP

3.1 HMI/RDU Network Termination Switch (See Figure 3)

Each HMI and RDU has a network termination switch in close proximity to the RS-485 network terminal block. The two products of the SMU/HMI/RDU/AOE system positioned at the network ends must have their termination switches "on". The rest of the devices on the network must have their termination switches "off".

3.2 HMI/RDU System Reset Switch (See Figure 3)

Momentary closure of the pushbutton switch will "restart" the HMI or RDU. User-programmed values or selections will be retained. Measurements and associated outputs will be recalculated based on user-programmed settings and the SMU measurement data.

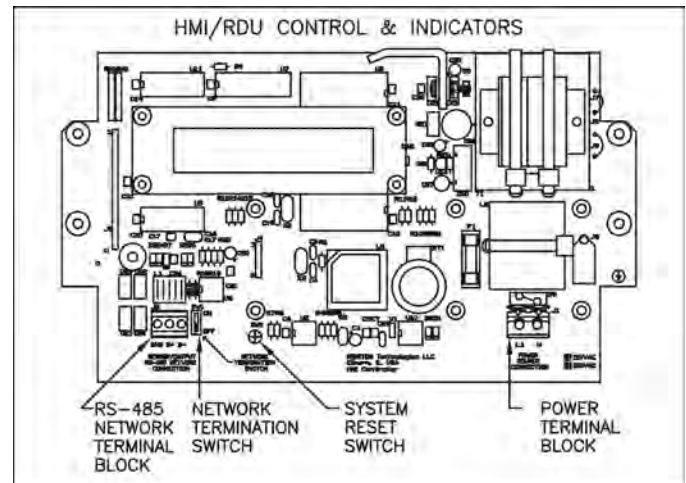


Figure 3

GENERAL OPERATION

4.1 General Operational Guidelines - All SMU versions

- 1) Operation duty cycle** - Although the SMU has passed tests that have accumulated over 150,000 operations, it is recommended that the SMU be utilized as a periodic measurement device. Applications requiring measurement more than fifty times in a 24 hour period are not recommended. However, there are no physical limitations to the number of operations which can occur in one hour (i.e. the motor can run continuously and not overheat). For a fully continuous measurement device, consult the factory for other technologies such as ultrasonics.
- 2) Measurement rate** - The average measurement rate of an SMU is influenced by the amount of cable on the storage reel. The speed of the plumb bob descent and ascent is faster when more cable is wound on the storage reel. The rate of plumb travel can range from 1.0-1.5ft/sec (300-450mm/sec).
- 3) Application restrictions** - The SMU is equipped with a motor and spring tension system which is designed to maximize the pull-out capacity in the event that a plumb bob becomes entangled or buried. The SMU has been successfully tested for operation in silo filling cycles and free flowing material applications. In applications where severe bridging or clinging occurs, it is not recommended to operate during a filling operation. Consult the factory for additional recommendations.

4.2 Operation of SMU/HMI System

- 1) Ensure SMU network address is set and that the HMI channel is active.
- 2) Press MEAS to enter the measurement mode.
- 3) Use number pad to enter channel number, or use arrow key to select "all" channel read.
- 4) Press ENTER.
- 5) SMU's plumb bob will descend as depicted by "↓" on HMI display.
- 6) Upon material contact the new measurement will be displayed and the plumb bob will ascend as depicted by the "↑" on the HMI display.
- 7) Once returned to the start/socket position, the "↑" will disappear. If any errors were detected, they will be indicated on the HMI. The following error conditions are analyzed and displayed if applicable.
 - Com Error: Communication between HMI and SMU is faulty
 - Return Error: The measurement of descent was greater than the ascent
 - Index Error: The measurement of ascent was greater than the descent
 - Motion Error: The plumb bob did not move upon initiation of a measurement cycle.

4.3 The Operator Panel (See Figure 4)

LCD Module: The LCD is a 2 line by 20 character dot-matrix module capable of indicating numbers, letters and symbols. The back-lighting enhances readability in low light areas and also improves the viewing range. The menus have a consistent layout making recognition of mode and selections very evident.

LED Indicators: There are eight (8) status LEDs in the operator panel. Four (4) LEDs are used to indicate the activated mode (DSPLY, MEAS, CHL PROG, and SYS PROG). Two (2) LEDs (SYS ERROR and CHL ERROR) are used to indicate when an error has been detected in the system and/or on a particular channel. Two (2) LEDs (RELAY A and RELAY B) are used to indicate the status of the relays assigned to the displayed channel.

Keypad: There are twenty (20) keys on the operator panel. Four (4) keys select the mode of operation (DSPLY, MEAS, CHL PROG, SYS PROG). Two (2) keys are used for navigating through the menus (←, →). Twelve (12) keys support data entry (0-9, decimal point, and CE). The ENTER key stores data into memory. SCAN/TIME is a dual function key used to view measurements of all channels (single key stroke), or to view the clock/calendar (two key strokes).

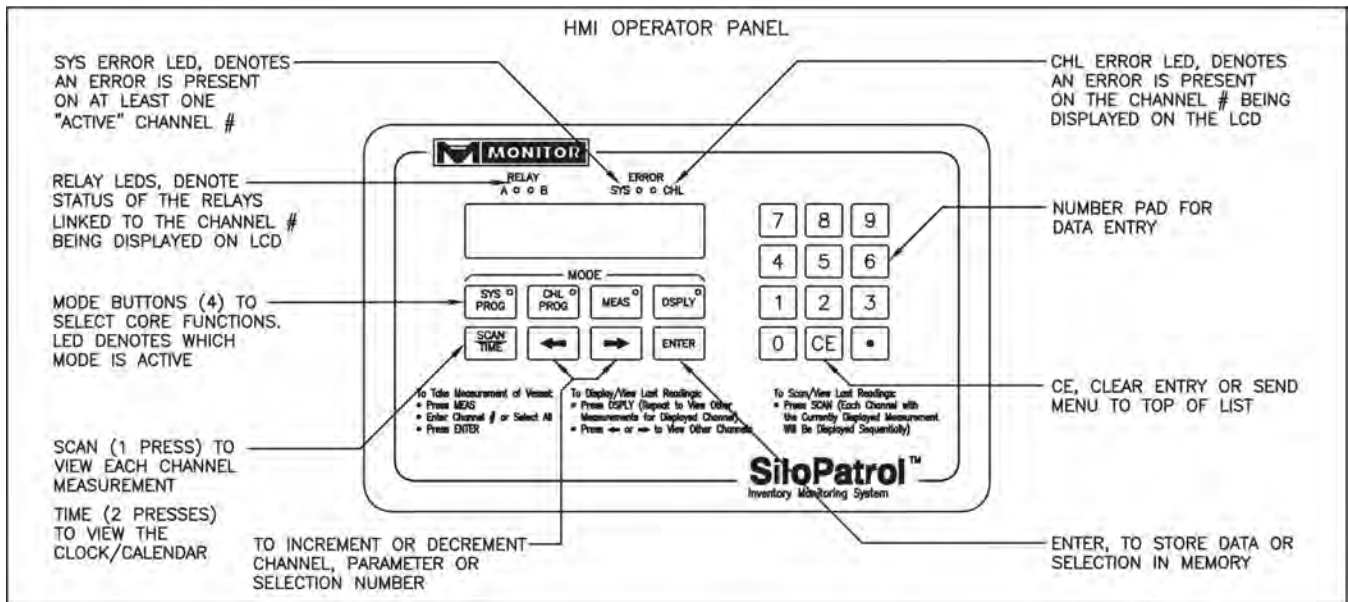


Figure 4

4.4 Basic Operation Modes

DSPLY (Display Mode): This mode permits the operator to view the measurement, relay LEDs, error LEDs, and operating status of each channel. The typical screen includes channel number, channel name, operating status, measurement description and the measurement value. The RelayA and RelayB LEDs located directly above the display illuminate when the associated relay is "energized" as determined by the user-programmable functions. The System Error LED located directly above the display illuminates whenever an error is detected in the system. The Channel Error LED also illuminates when an error is detected on the channel being displayed. If an error occurs, the error type is stated in the "status" screen. SMU operating status is indicated on the LCD as "↓" for downward travel, "↑" for upward travel, and "blank" for SMU not running.

Screen 1

01: Channel Name ↑
Distance ###.## ft

Screen 2

01: Channel Name ↑
Level ###.## ft

MEAS (Measure Mode): This mode permits the operator to manually initiate a measurement of a SMU via the keypad. The operator is given the choice of initiating one or all sensors. While in this mode, communication with sensors is halted. Relay and Error LEDs are shut off until return to DSPLY mode. After initiation of a sensor, the HMI returns automatically to DSPLY mode. The typical screen includes function description and the selection.

Screen 1

Take Measurement of:
+Channel ** 1/2

Screen 2

Take Measurement of:
-All Channels 2/2

SYS PROG (System Programming Mode): This mode permits the operator to view or program each of the system parameters of the HMI. By definition, a system parameter influences system configuration and forces all channel parameters to conform. While in this mode, communication with sensors is halted. Relay and Error LEDs are shut off until return to DSPLY mode. A typical screen includes system parameter number, parameter description, and selection.

Screen 1

**/SP03 Unit-system
+English 1/2

Screen 2

**/SP03 Unit-system
-Metric 2/2

CHN PROG (Channel Programming Mode): This mode permits the operator to view or program each of the channel parameters for each channel of the HMI. By definition, a channel parameter permits each channel to be configured independent from other channels. While in this mode, communication with sensors is halted. Relay and Error LEDs are shut off until return to DSPLY mode. A typical screen includes channel number, channel parameter number, parameter description, and selection.

Screen 1

16/CP01 Chnl State
+Active 1/2

Screen 2

16/CP01 Chnl State
-Inactive 2/2

4.5 Other Important Features

SCAN: This function allows a quick review of a particular measurement/status for all channels with one key stroke. The respective channel status Relay and Error LEDs are also updated during SCAN. This function does not initiate a new measurement. It solely displays the latest information regarding each channel. The measurement type (distance, level, volume, weight, percent, status) which is being displayed immediately prior to pressing SCAN, will be indicated.

Screen 1

Scan01: Channel Name
Distance ###.## ft

Screen 2

Scan02: Channel Name
Distance ###.## ft

TIME: This screen displays the time, date, and day along with the current hardware and software configurations. Time setting is critical for the automatic measurement function. This screen is activated by two successive presses of the SCAN/TIME key.

HMI 16-CH Ver 1.20
12:34PM Mon 08/21/00

Error Messages: Indication of errors is important so a system can be repaired as soon as possible. The ERROR LEDs give general information which is further detailed by the status screen in the DSPLY mode. If any type of error in any channel is detected, the SYS ERROR LED will illuminate. If the channel number being displayed in the DSPLY mode is reporting an error, then the CHL ERROR LED will also illuminate. The status screen will report one of the following:

- **Com Error:** Communication between the sensor (SMU) and HMI is unsuccessful.
- **Index Error:** The sensor has measured a greater distance in upward travel than in downward travel. The starting (index) location of plumb bob used for the last reading is in question.
- **Return Error:** The sensor has measured a greater distance in downward travel than in upward travel. The ending (return) location of plumb bob after last reading is in question.
- **Motion Error:** The sensor can not detect any plumb bob movement. Cause could be a broken cable, a plumb bob frozen to the flange, a buried plumb bob, or excess drag in the wiper seal.

01: Channel Name
Status: Com Error

The following explanations summarize how to perform certain functions. When applicable, referrals are made to other parts of this manual where more detail exists.

PROGRAMMING: GETTING STARTED

5.1 The Essentials

The HMI is designed to make the task of initiating and viewing measurements easy. Therefore "getting started" was made as simple as possible. Once mechanically installed, and electrically wired to the SMUs, the HMI can be used immediately. The HMI is "plug-and-play" for those applications where distance measurements are adequate and where manual initiation is suitable. No programming is required. Optimizing the system can be done as explained below providing that all wiring is complete and each SMU has had its network address properly set and any unused HMI channels have been deactivated.

5.2 How to Activate/Disable a Channel

- All the channels of the HMI default into an "active" state. Channels not connected to SMUs will report "com errors". Optimize system by disabling those channels which are not connected to SMUs. See detail in CP01.
- This will also rid system of error LEDs that mask potential errors of critical channels. Furthermore, this optimization will make HMI most efficient in scanning the sensor network.

5.3 How to View Channel Measurements

- Enter the DSPLY mode by pressing the DSPLY key. Upon entering the DSPLY mode, the last previously viewed channel and measurement is displayed.
- To view other measurements of this channel, press the DSPLY key again. The next highest priority measurement will be displayed. Continue to press and release the DSPLY key to view all data including channel status until returning to the original measurement screen.
- To view other channels, use the arrow keys.

5.4 How to Initiate Manual Silo Measurements

- Enter the MEAS mode by pressing the MEAS key. Upon entering the MEAS mode, the first selection screen is displayed. Enter the appropriate channel number followed by ENTER. The HMI acknowledges entry by automatically exiting MEAS mode and returning to DSPLY mode. The channel which was selected for measurement will be the channel number displayed.
- To view other selections, use the arrow keys. The second selection is for "all" channels to be measured. Press ENTER. Once pressed, the HMI acknowledges entry by automatically exiting MEAS mode and returning to DSPLY mode. Channel 01 measurement data will be displayed.

5.5 How to Program System Parameters

- Enter the SYS PROG mode by pressing the SYS PROG key. Upon entering the SYS PROG mode, system parameter 01 (SP01), its description, and its active selection appear. The system parameter number will be blinking.
- To view other system parameters, use the arrow keys. A single press moves one parameter. After key is held for 1 second, the parameters will quickly scroll until key is released.
- To view other selections for the present parameter, press the SYS PROG key again. The status symbol (+ or -) will be blinking denoting this portion of the screen can be scrolled using the arrow keys. A single press moves one selection. After key is held for 1 second, the selections will quickly scroll until key is released.
- To activate a selection from a list, find the appropriate selection using the arrow keys followed by pressing ENTER. The HMI will acknowledge entry by denoting the selection with "+". Selections appearing with "-" are considered "not active". When programming a parameter which requires entry from the number pad, the new data must be entered followed by pressing ENTER. The HMI will acknowledge entry by denoting entry with "+". Data appearing with "-" is considered "not active".

5.6 How to Program Channel Parameters

- Enter the CHL PROG mode by pressing the CHL PROG key. Upon entering the CHN PROG mode, channel 01, channel parameter 01 (01/CP01) and its active selection appear. The channel number will be blinking.
- To view other channels (CP01 will remain for each channel) use the arrow keys. A single press moves one channel. After key is held for 1 second, the channel number will quickly scroll until key is released.
- To view a different parameter, press the CHN PROG until the channel parameter number blinks denoting this portion of the screen can be scrolled using the arrow keys. A single press moves one parameter. After key is held for 1 second, the parameter numbers will quickly scroll until key is released.
- To view other selections for the present parameter, press the CHN PROG key until the status symbol (+ or -) blinks denoting this portion of the screen can be scrolled using the arrow keys. A single press moves one selection. After key is held for 1 second, selections will quickly scroll until key is released.
- To activate a selection from a list, find the appropriate selection using the arrow keys followed by pressing ENTER. The HMI will acknowledge entry by denoting the selection with "+". Selections appearing with "-" are considered "not active". When programming a parameter which requires entry from the number pad, the new data must be entered followed by pressing ENTER. The HMI will acknowledge entry by denoting entry with "+". Data appearing with "-" is considered "not active".

5.7 How to Set the Clock/Calendar

- The clock is particularly important when using the automatic measurement mode. The date, day and time are all critical information to program. See detail in SP08, SP09, and SP10. All three parameters are set at factory. Time will require reprogramming if in a different timezone.
- The clock system is Y2K compatible and has a battery backup which is sized to maintain clock settings with power off for five years.

5.8 How to Establish English or Metric Units

- The HMI defaults to English units but can easily be changed to Metric. The units-system and units for volume and weight will require selection. See detail in SP03, SP04 and SP05.
- Any data previously entered in a parameter where units have changed should be reviewed. The previous entered data is retained. The HMI does not automatically re-scale previous entries.

5.9 How to Enter a Channel Name

- Each channel can be given a unique identifying name. Since an alphanumeric keypad is not available, entry of letters, numbers and symbols must be done by scrolling method. See detail in CP12. Use the "7" key to move cursor left and "9" key to move cursor right. Scrolling of characters is done with arrow keys. ENTER must be pressed to save characters in memory.

5.10 How to Initiate Automatic Silo Measurements

- Automatic measurements are based on the real-time clock within the HMI. Be sure the clock parameters SP08, SP09, SP10 are set correctly. Press SCAN/TIME twice to observe.
- Decide if manual operation is to be allowed with the automatic operation. Setup SP01 accordingly.
- Determine which days, timeframe, and interval that automatic operation will occur. See detail on CP02, CP03, and CP04.

5.11 How to Copy or Default Channel Information

- If many of a channel's parameters are similar to another, the copy function found in SP11 may be very beneficial in simplifying and speeding the programming process.
- Sometimes it important to start a programming session over and return HMI to the original settings. Global or individual channel default functions are available in SP11.

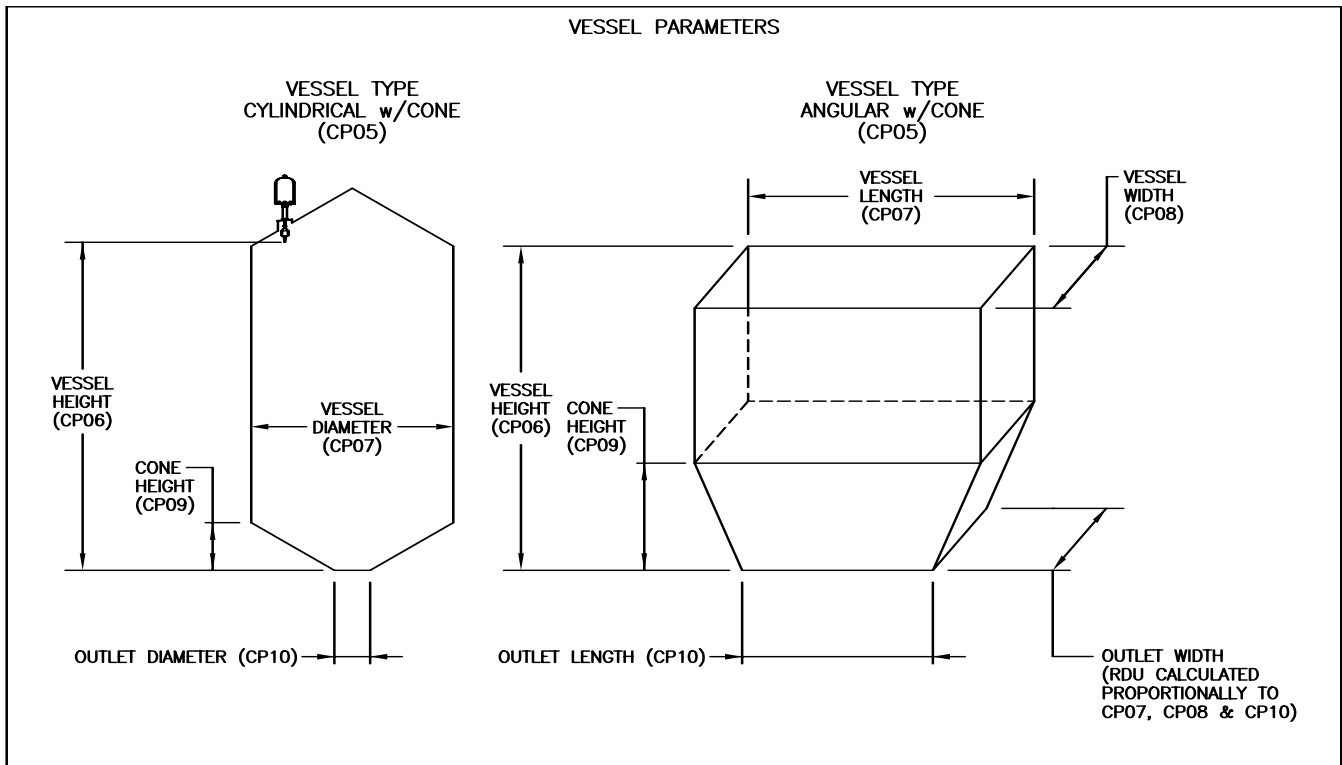


Figure 5

5.12 How to Achieve Volumetric/Weight Calculations (See Figure 5)

- Calculations are based on entries of vessel dimensions and bulk density. See detail of CP05, CP06, CP07, CP08, CP09, CP10 and CP11. Note it is important to establish Vessel Height (CP06) as the distance from the bottom of silo to the mounting point of the SMU.
- There are extreme limits for each of these dimensional parameters. Validity of some values are conditional on a related parameter (i.e. vessel height must be greater or equal to cone height).

5.13 How to Generate a mA/Percentage Calculation

- This calculation can be based on level, volume or weight as selected by system parameter SP06. This parameter must be setup prior to establishing the 20mA/100% (CP13) and 4mA/0% values (CP14). Calculation can be performed within a narrow region of the overall vessel capacity as established by CP13 and CP14.

5.14 How to Setup/Test an Analog Output

- Identify the exact output within an AOE which will be linked to the HMI. Establish the associated link per CP15 by identifying the AOE address, card location and output number.
- Establish basis for the mA/% calculation (level, volume, weight) with SP06.
- Enter the values which will represent the 20mA/100% limit (CP13) and the 4mA/0% limit (CP14).
- Select how analog output should respond in the event of an error on the respective channel. Make selection in CP19.
- Test the functionality of the analog output by forcing the output to a particular level (CP16).
- If the current measurement does not match the forced output (via CP16), then fine tune measured current output with the 4mA offset (CP17) and 20mA offset (CP18).

5.15 How to Setup/Test a Relay Output (Relay A and Relay B identical)

- Identify the exact output within an AOE which will be linked to the HMI. Establish the associated link per CP20 or CP26 by identifying the AOE address, card location and output number.
- Establish calculation basis (level, volume, weight, %, distance) with CP22 or CP28.
- Select the function which will be assigned to the respective relay via CP23 and CP29.
- Enter the value/values required by the function selected via CP24, CP25 or CP30, CP31.
- Test the functionality of the relay output by forcing the output to a particular state (CP21 or CP27).

5.16 How to Query Sensors for Diagnostic Information

- The sensors store performance data in their own non-volatile memory. Reference CP32. Each successful sensor measurement (i.e. a SMU operation which did not report any errors) is accumulated and reported in "Cycles". Each unsuccessful sensor measurement (i.e. a SMU operation which reported an index, return, or motion error) is accumulated and reported in "Errors". This data is very helpful in evaluating reliability of the sensor measurements and can infer when sensor maintenance is required.

PARAMETER EXPLANATION/DISPLAY EXAMPLES

6.1 System Parameters (SP##) (INACTIVE IN RDU)

SP01: Measurement Mode

Definition: Determines how the HMI will instruct the SMUs to take new readings (i.e. cause the plumb bob to descend). "Manual" measurements are initiated via the HMI keypad. "Automatic" measurements are initiated via on-board clock and user selected time bases.

Default: Manual

Menu selection required:

- 1) Manual: All requests initiated via the HMI keypad will be acknowledged. All automatic initiations programmed on any channel will be ignored.
- 2) Automatic: All requests initiated via the programmed timeframes established per channel will be acknowledged. All manual initiations for any channel will be ignored.
- 3) Manual/Automatic: All requests, whether initiated manually from HMI keypad or automatic initiations programmed on any channel will be acknowledged.

Screen 1	**/SP01 Meas Mode +Manual 1/3
----------	----------------------------------

Screen 2	**/SP01 Meas Mode -Auto 2/3
----------	--------------------------------

Screen 3	**/SP01 Meas Mode -Manual/Auto 3/3
----------	---------------------------------------

SP02: Display Measurement Priority

Definition: Determines the measurement which will be displayed "first" after a sensor measurement request. The user has the capability to select distance, level, volume, weight or percent-full. All other measurements maintain their order.

Default: Distance, Level, Volume, Weight, %

Menu selection required:

- 1) Distance: Distance from sensor to material level (air).
- 2) Level: Height of material based on Vessel Height (CP06)
- 3) Volume: Calculated material volume based on material height and vessel geometry.
- 4) Weight: Calculated material weight based on material height, vessel geometry and bulk density.
- 5) Percentage: Calculated percentage of material in accordance to the % assignment and the individual channel 0% and 100% values.

Screen 1	**/SP02 Dsply Prior +Distance 1/5
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Screen 2	**/SP02 Dsply Prior -Level 2/5
----------	-----------------------------------

Screen 3	**/SP02 Dsply Prior -Volume 3/5
----------	------------------------------------

Screen 4	**/SP02 Dsply Prior -Weight 4/5
----------	------------------------------------

Screen 5	**/SP02 Dsply Prior -Percentage 5/5
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SP03: Units-system

Definition: Selects the fundamental engineering unit system to be used in all calculations and displays. Selection of "English" or "Metric" will cause units of distance, volume, weight, and bulk density to all follow convention.

Default: English

Menu selection required:

- 1) English: Will cause distance/level units to be "feet" (1 ft = 0.3048 m), volume units to be "eng bushels", "cubic ft", or "gallons", weight units to be "lbs" or "tons"(english), and bulk density units to be "lbs/cubic ft".
- 2) Metric: Will cause distance/level units to be "meters" (1 m = 3.28083 ft), volume units to be "metric bushels", "cubic meters", or "liters", weight units to be "kgs" or "tons"(metric), and bulk density units to be "kgs/cubic m".

Screen 1	**/SP03 Unit-system +English 1/2
----------	-------------------------------------

Screen 2	**/SP03 Unit-system -Metric 2/2
----------	------------------------------------

SP04: Units-volume

Definition: Selects the engineering units associated with volume in accordance to the Units of System chosen. There are three unit selections for "English" and three for "Metric".

Default: ft3 (if English), m3 (if Metric)

Menu selection required: (if English)

- 1) **ft3**: Cubic Feet; conversions are 1 ft3 = 0.8036 bu(US), 1 ft3 = 0.02832 m3
- 2) **bu**: Bushel(US); conversions are 1 bu(US) = 1.24446 ft3, 1 bu(US) = 0.96894 bu(Brit)
- 3) **gal**: Gal(US liq); conversions are 1 gal = 0.13368 ft3, 1 gal = 3.7854 liters

Menu selection required: (if Metric)

- 1) **m3**: Cubic Meter; conversions are 1 m3 = 27.4962 bu(Brit), 1 m3 = 35.3147 ft3
- 2) **bu**: Bushel(Brit); conversions are 1 bu(Brit) = 0.0363687 m3, 1 bu(Brit) = 1.03206 bu(US)
- 3) **l**: Liter; conversions are 1 liter = 0.001 m3, 1 liter = 0.26417 gal(US liq)

	English	Metric
Screen 1	**/SP04 Unit-volume +Cu feet (ft3) 1/3	**/SP04 Unit-volume +Cu meter (m3) 1/3
Screen 2	**/SP04 Unit-volume -Bushel-US (bu) 2/3	**/SP04 Unit-volume -Bushel-BR (bu) 2/3
Screen 3	**/SP04 Unit-volume -Gallon (gal) 3/3	**/SP04 Unit-volume -Liter (l) 3/3

SP05: Units-weight

Definition: Selects the engineering units associated with weight in accordance to the Units of System chosen. There are two unit selections for "English" and two for "Metric".

Default: lb (if English), kg (if Metric)

Menu selection required: (if English)

- 1) **lb**: Pound(avdp); conversions are 1 lb = .0005 tons(short), 1 lb = .4536 kg
- 2) **ton**: Ton(short); conversions are 1 ton(short) = 2000 lbs, 1 ton(short) = 0.90718 ton(metric)

Menu selection required: (if Metric)

- 1) **kg**: Kilogram; conversions are 1 kg = .001 ton(metric), 1 kg = 2.20462 lb
- 2) **ton**: Ton(metric); conversions are 1 ton(metric) = 1000 kg, 1 ton(metric) = 1.1023 ton(short)

	English	Metric
Screen 1	**/SP05 Unit-weight +Pound (lb) 1/2	**/SP05 Unit-weight +Kilogram (kg) 1/2
Screen 2	**/SP05 Unit-weight -Ton (tn) 2/2	**/SP05 Unit-weight -Tonne (t) 2/2

SP06: mA & % Calculation Mode

Definition: Selects from what basis calculations are made. Calculations for percentage and process current outputs are identical and are always based on amount of material (i.e. level, volume, weight). The calculation for weight or volume is influenced by tank geometry (cone) and therefore is different than a level calculation. Calculation for weight and volume is identical but a user selection is provided so appropriate units can be automatically assigned to channel parameters which permit dictation of the 4mA/0% and 20mA/100% limits.

Default: Level

Menu selection required:

- 1) **Level**: Percent-full based on material height in vessel.
- 2) **Volume**: Percent-full based on material height and vessel geometry.
- 3) **Weight**: Percent-full based on material height, vessel geometry and material bulk density.

Screen 1	**/SP06 mA/% Calc +Level 1/3	Screen 2	**/SP06 mA/% Calc -Volume 2/3
Screen 3	**/SP06 mA/% Calc -Weight 3/3		

SP07: Password

Definition: Selects whether system and channel parameters can be accessed through the HMI keypad without the entry of a password. If a password is selected, than password entry is required before access to system or channel parameters is granted.

Default: 0000 (no password required for entry)

Number entry required:

Range: 0000 through 9999

Defined: 0000: interpreted as "password inactive"

Screen 1	**/SP07 Set Passwr +#### 1/1
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Log-in screens: When a password is assigned (other than 0000), access to system parameters or channel parameters will require password entry. The log-in screen will appear as follows. The relevant mode LED will illuminate when this screen is displayed so it is apparent what mode is desired for access. If password is valid, the screen will immediately change to the default as dictated in the "mode" definition section of this guideline. If the password is invalid, the screen will automatically return to request a new password. This screen (and mode) can be exited by pressing any other mode keys: MEAS, DSPLY, or the opposite parameter mode key (in which case the password screen will remain but mode LED will appear differently).

Screen 1	Password Protected Enter Password: ####
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SP08: Clock-Set Date

Definition: Permits user to establish the date (month, day, year) to be assigned to the HMI for use with the automatic measurement mode feature.

Default: As Processed

Menu Selection required:

- 1) As Processed: Is a null command which will do nothing if selected. Is included as a selection (and as default) to protect operator from inadvertently setting date.
- 2) MM/DD/YY: Permits date change in following format
MM (month- range 01 to 12), DD (day- range 01 to 31), YY (year- range 00 to 99)

Screen 1	**/SP08 Set Date +As Processed 1/2
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Screen 2	**/SP08 Set Date -MM/DD/YY 2/2
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SP09: Clock-Set Time

Definition: Permits user to establish the time (hours, minutes) to be assigned to the HMI for use with the automatic measurement mode feature. The screen which correlates to the present internal clock will show the time (##:## AM or PM) while the opposite screen will show no time (:).

Default: As Processed

Menu Selection required:

- 1) As Processed: Is a null command which will do nothing if selected. Is included as a selection (and as default) to protect operator from inadvertently resetting time.
- 2) AM Mode: Permits use of traditional time (non-military) using AM for early morning and morning timeframes. Time to be entered with keypad in format explained below.
- 3) PM Mode: Permits use of traditional time (non-military) using PM for afternoon and evening timeframes. Time to be entered with keypad in format explained below.

HH (hour- range 01 to 12), MM (minute- range 00 to 59)

Screen 1	**/SP09 Set Time +As Processed 1/3
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Screen 2	**/SP09 Set Time -AM Mode HH:MM 2/3
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Screen 3	**/SP09 Set Time -PM Mode HH:MM 3/3
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SP10: Clock-Set Weekday

Definition: Permits user to establish the day (Mon, Tues, etc.) to be assigned to the HMI for use with the automatic measurement mode feature. The new day is shown only while in this parameter.

Default: As Processed

Menu Selection required:

- 1) As Processed: Is a null command which will do nothing if selected.
- 2-8) Monday-Sunday: Assigns the particular weekday shown

Screen 1	**/SP10 Set Weekday +As Processed 1/8	Screen 2	**/SP10 Set Weekday -Monday 2/8
Screen 3	**/SP10 Set Weekday -Tuesday 3/8	Screen 4	**/SP10 Set Weekday -Wednesday 4/8
Screen 5	**/SP10 Set Weekday -Thursday 5/8	Screen 6	**/SP10 Set Weekday -Friday 6/8
Screen 7	**/SP10 Set Weekday -Saturday 7/8	Screen 8	**/SP10 Set Weekday -Sunday 8/8

SP11: Parameter Set Functions

Definition: Permits block programming of parameters in order to save data entry time. To avoid accidental changes, exiting this parameter will always reestablish the default.

Default: Existing Set

Menu selection required:

- 1) Existing Set: Is a null command which will do nothing if selected. Is included as a selection (and as default) to protect operator from inadvertent programming.
- 2) Copy Chnl ## to Chnl ##: Copies all channel parameters to another channel. Entry of both channel numbers will be required otherwise no action will be taken.
- 3) Default Chnl ##: The channel entered will be fully defaulted.
- 4) Default: When selected all system and channel parameters will return to default values.

Screen 1	**/SP11 Paramtr Set +Existing Set 1/4	Screen 2	**/SP11 Paramtr Set -Copy CH## ## 2/4
Screen 3	**/SP11 Paramtr Set -Default CH ## 4/4	Screen 4	**/SP11 Paramtr Set -Default all 4/4

SP12: Factory Setup

Definition: Allows factory personnel to establish proper relationship between hardware and software to insure proper operation for users. The displayed value indicates how many channels can be processed by the HMI.

Default: As Processed

Menu Selection required:

- 1) As Processed: Is a null command which will do nothing if selected.
- 2) Hrdwr: Depicts the number of channels that the hardware and software can process.

Screen 1	**/SP12 Fctry Setup +As Processed 1/2	Screen 2	**/SP12 Fctry Setup +Hrdwr ##### 2/2
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6.2 Channel Parameters (CP##)

CP01: Channel Status

Definition: Determines whether the particular channel number will be included in the HMI's periodic communication scan of the sensor network. Responsiveness of communication is improved when the number of active channels is optimized.

Default: Active

Menu selection required:

- 1) Active: Enables the channel number for the communication scan of the sensor network.
- 2) Inactive: Disables the channel number from the communication scan of the sensor network.

Screen 1	##/CP01 Chnl State +Active 1/2	Screen 2	##/CP01 Chnl State -Inactive 2/2
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CP02: Automatic Measurement Mode Days (INACTIVE IN RDU)

Definition: Selects which "days" of the week will be activated for automatic measurement mode (i.e. which days the HMI will automatically instruct this channel's SMU to take a reading.) There is an option for "none" since there are applications where certain channels will require automatic readings and others (connected to same HMI) which require manual readings only. The system parameter (measurement mode) can not discriminate such.

Default: None

Menu selection required:

- 1) None: Disables automatic measurements for this channel independent of setting for system parameter measurement mode (SP01). Selections for automatic measurement mode time (CP03) and interval (CP04) will be ignored.
- 2) Mon-Fri: Enables automatic measurements for this channel for these days only. This setting will be acknowledged only if the system parameter measurement mode (SP01) permits automatic measurements.
- 3) Daily: Enables automatic measurements for this channel for all days of the week. This setting will be acknowledged only if the system parameter measurement mode (SP01) permits automatic measurements.

Screen 1	##/CP02 AutoMeasDay +None 1/3	Screen 2	##/CP02 AutoMeasDay -Mon → Fri 2/3
Screen 3	##/CP02 AutoMeasDay -Daily 3/3		

CP03: Automatic Measurement Mode Time (INACTIVE IN RDU)

Definition: Selects which "time" during day will be activated for automatic measurement mode (i.e. which hours the HMI will automatically instruct this channel's SMU to take a reading). This setting will be acknowledged only if the system parameter measurement mode (SP01) permits automatic measurements.

Default: 7am-3pm

Menu selection required:

- 1) 7am-3pm: Enables automatic measurements for this channel for these hours only.
- 2) 3pm-11pm: Enables automatic measurements for this channel for these hours only.
- 3) 11pm-7am: Enables automatic measurements for this channel for these hours only.
- 4) 24 hours: Enables automatic measurements for this channel for all hours of the day.

Screen 1	##/CP03 AutoMeasTim +7am → 3pm 1/4	Screen 2	##/CP03 AutoMeasTim -3pm → 11pm 2/4
Screen 3	##/CP03 AutoMeasTim -11pm → 7am 3/4	Screen 4	##/CP03 AutoMeasTim -24 hours 4/4

CP04: Automatic Measurement Mode Interval (INACTIVE IN RDU)

Definition: Selects the time "interval" that will be activated for automatic measurement mode (i.e. how often the HMI will automatically instruct this channel's SMU to take a reading in accordance to the day and time settings). This setting will be acknowledged only if the system parameter measurement mode (SP01) permits automatic measurements. All automatic readings are taken on the hour (i.e. HH:00) or half hour (i.e. HH:30) with reference to the eight hour shift pattern (CP03).

Default: 8 hours

Menu selection required:

- 1) 8 hour: Enables automatic measurement for this channel every 8 hours.
- 2) 4 hour: Enables automatic measurement for this channel every 4 hours.
- 3) 1 hour: Enables automatic measurement for this channel every 1 hour.
- 4) 1/2 hour: Enables automatic measurement for this channel every 1/2 hour.

Screen 1	##/CP04 AutoMeasInv +8 hr intrvl 1/4	Screen 2	##/CP04 AutoMeasInv -4 hr intrvl 2/4
Screen 3	##/CP04 AutoMeasInv -1 hr intrvl 3/4	Screen 4	##/CP04 AutoMeasInv -1/2 hr intrvl 4/4

CP05: Vessel Type

Definition: Selects the vessel's geometric shape which is basis for volumetric and weight calculations.

Default: cylinder w/cone

Menu selection required:

- 1) Cylinder w/cone: Calculation will be based on a cylinder with a center discharge cone. Required dimensional parameters include vessel height, vessel diameter, cone height and outlet diameter. A coneless vessel can be calculated by entering no dimension for the cone height.
- 2) Angular w/cone: Calculation will be based on a three-dimensional rectangle with a center discharge cone. Required dimensional parameters include vessel height, vessel length, vessel width, cone height, and outlet length. User entry of the outlet width is not allowed. It is calculated internally assuming proportional relationship of overall length and width to outlet length and width. A coneless vessel can be calculated by entering no dimension for cone height.

Screen 1	##/CP05 Vessel Type +cyldr w/cone 1/2	Screen 2	##/CP05 Vessel Type -anglr w/cone 2/2
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CP06: Vessel Height (max)

Definition: Assigns the overall height of the vessel from which the calculations of level, volume, and weight will be made. Value entered should be the distance between bottom of sensor plumb bob and the vessel bottom. The units displayed on this screen is dependent on the Units-system parameter selection. The entry field size is limited by the maximum distance allowed by the measurement, and must be greater than value of Vessel Cone Height (CP09).

Default: 0, for both units (English or Metric)

Number entry required:

Range: 150 feet, 46 meters

	English		Metric
Screen 1	##/CP06 Vssl Height + ###.## ft 1/1	Screen 1	##/CP06 Vssl Height + ###.## m 1/1

CP07: Vessel Diameter/Length

Definition: Assigns the diameter or length of vessel from which the calculations of volume, and weight will be made. The screen displayed is dependent on the Units-system parameter and the Vessel-type parameter. The entry field size is limited by the maximum distance allowed by the measurement.

Default: 0, for both units (English or Metric)

Number entry required:

Range: 125 feet, 38 meters

	English		Metric
Screen 1	##/CP07 Vssl Diamtr + ###.## ft 1/1	Screen 1	##/CP07 Vssl Diamtr + ###.## m 1/1
	OR		OR
Screen 1	##/CP07 Vssl Length + ###.## ft 1/1	Screen 1	##/CP07 Vssl Length + ###.## m 1/1

CP08: Vessel Width

Definition: Assigns the width of vessel from which the calculations of volume, and weight will be made. The screen displayed is dependent on the Units-system parameter and the Vessel-type parameter. The entry field size is limited by the maximum distance allowed by the measurement.

Default: 0, for both units (English or Metric)

Number entry required:

Range: 125 feet, 38 meters

	English		Metric
Screen 1	##/CP08 Vssl Width + ###.## ft 1/1	Screen 1	##/CP08 Vssl Width + ###.## m 1/1
	OR		OR

English

Metric

Screen 1

##/CP08	Not Used
+ ###.##	1/1

##/CP08	Not Used
+ ###.##	1/1

CP09: Vessel Cone Height

Definition: Assigns the cone height of the vessel from which the calculations of level, volume, and weight will be made. Value entered should be distance between vessel bottom and hip of the vessel (cone and straight wall interface). The units displayed on this screen is dependent on the Units-system parameter selection. The entry field size is limited by the maximum distance allowed by the measurement and must be less than value of Vessel Height (CP06).

Default: 0, for both units (English or Metric)

Number entry required:

Range: 150 feet, 46 meters

English

Metric

Screen 1

##/CP09 Vssl Cn Hgt	
+ ###.## ft	1/1

##/CP09 Vssl Cn Hgt	
+ ###.## m	1/1

CP10: Vessel Outlet Diameter/Length

Definition: Assigns the diameter or length of vessel outlet from which the calculations of volume, and weight will be made. With angular vessels, the width is determined by the HMI and is assumed to be proportional to the length and width of the primary vessel dimensions. The screen displayed is dependent on the Units-system parameter and the Vessel-type parameter. The entry field size is limited by the maximum distance allowed by the measurement and must be less than the value of Vessel Diameter/Length (CP07).

Default: 0, for both units (English or Metric)

Number entry required:

Range: 10 feet, 3 meters

English

Metric

Screen 1

##/CP10 Outlet Dmtr	
+ ##.## ft	1/1

##/CP10 Outlet Dmtr	
+ ##.## m	1/1

OR

OR

Screen 1

##/CP10 Outlet Lgth	
+ ##.## ft	1/1

##/CP10 Outlet Lgth	
+ ##.## m	1/1

CP11: Bulk Density

Definition: Assigns Bulk Density of material so weight can be calculated by multiplying against volume. Engineering unit displayed is in accordance to the Units of System chosen.

Default: 000.0 lbs/ft3 (if English), 0000.0 kgs/m3 (if Metric)

Number entry required:

Range: 000.1 to 200.0 (English), 0000.1 to 3203.6 (Metric); 1 lbs/ft3 = 16.018 kgs/m3

English

Metric

Screen 1

##/CP11 BulkDensity	
+ #####.## lbs/ft3	1/1

##/CP11 BulkDensity	
+ #####.## kgs/m3	1/1

CP12: Vessel Name

Definition: Permits user to assign a textual name to the vessel. This name will always be displayed with the activated channel number in the DSPLY mode. Each of the 12 character positions will be set by scrolling through available characters using the arrow keys. Movement to next character position is controlled by the "7" key (move left) and the "9" key (move right). ENTER must be pressed before exiting parameter to save programmed name in memory.

Default: all blank

Number entry required:

Range: space, #, -, 0-9, A-Z, a-z

Screen 1

##/CP12 Vessel Name	
+ abcdefghijkl	1/1

CP13: 20mA/100% Value

Definition: Assigns the value of either level, volume, or weight (as selected by the System Parameter- mA & % calculation SP06) for the 20mA and 100% representation. This permits the 20mA and 100% value to be different than the completely full limit. The units displayed in this screen are dependent on four system parameters: Units-system, Units-volume, Units-weight, mA & % calculation. The entry field size can accommodate seven digits. The default value "0" is not a legal programmed value. Entry of a number equal or less than the 4mA/0% value will be denied.

Default: 0, for all units (English or Metric)

Number entry required:

Range: 999.99 for ft or m, 9999999 for all others.

	English	Metric
Screen 1	##/CP13 20mA/100% + ###.## ft 1/1	##/CP13 20mA/100% + ###.## m 1/1
	OR	OR
Screen 1	##/CP13 20mA/100% +##### ft3 1/1	##/CP13 20mA/100% +##### m3 1/1
	OR	OR
Screen 1	##/CP13 20mA/100% +##### bu 1/1	##/CP13 20mA/100% +##### bu 1/1
	OR	OR
Screen 1	##/CP13 20mA/100% +##### gal 1/1	##/CP13 20mA/100% +##### l 1/1
	OR	OR
Screen 1	##/CP13 20mA/100% +##### lb 1/1	##/CP13 20mA/100% +##### kg 1/1
	OR	OR
Screen 1	##/CP13 20mA/100% +##### tn 1/1	##/CP13 20mA/100% +##### t 1/1

CP14: 4mA/0% Value

Definition: Assigns the value of either level, volume, or weight (as selected by the System Parameter- mA & % calculation SP06) for the 4mA and 0% representation. This permits the 4mA and 0% value to be different than the completely empty limit. The units displayed in this screen are dependent on four system parameters: Units-system, Units-volume, Units-weight, mA & % calculation. The entry field size can accommodate seven digits. The default value "0" is a legitimate programmed value. An entry of a number equal or greater than the 20mA/100% value (unless the 20mA/100% value is "0") will be denied.

Default: 0, for all units (English or Metric)

Number entry required:

Range: 999.99 for ft or m, 9999999 for all others.

	English	Metric
Screen 1	##/CP14 4mA/0% + ###.## ft 1/1	##/CP14 4mA/0% + ###.## m 1/1
	OR	OR
Screen 1	##/CP14 4mA/0% +##### ft3 1/1	##/CP14 4mA/0% +##### m3 1/1
	OR	OR

	English	Metric
Screen 1	<div style="border: 1px solid black; padding: 2px;"> ##/CP14 4mA/0% +##### bu 1/1 </div>	<div style="border: 1px solid black; padding: 2px;"> ##/CP14 4mA/0% +##### bu 1/1 </div>
	OR	OR
Screen 1	<div style="border: 1px solid black; padding: 2px;"> ##/CP14 4mA/0% +##### gal 1/1 </div>	<div style="border: 1px solid black; padding: 2px;"> ##/CP14 4mA/0% +##### l 1/1 </div>
	OR	OR
Screen 1	<div style="border: 1px solid black; padding: 2px;"> ##/CP14 4mA/0% +##### lb 1/1 </div>	<div style="border: 1px solid black; padding: 2px;"> ##/CP14 4mA/0% +##### kg 1/1 </div>
	OR	OR
Screen 1	<div style="border: 1px solid black; padding: 2px;"> ##/CP14 4mA/0% +##### tn 1/1 </div>	<div style="border: 1px solid black; padding: 2px;"> ##/CP14 4mA/0% +##### t 1/1 </div>

CP15: Process Current Circuit/Channel Link (INACTIVE IN RDU)

Definition: Permits user to assign a particular process current output to the channel displayed. The ability to independently assign output circuits to particular channels eliminates the need to buy more outputs than required and gives complete freedom from hardware constraints when assigning channel numbers to particular sensors. Linking requires associating a channel with an Auxiliary Output Enclosure (up to four can be added), the card position in the Auxiliary Output Enclosure (up to four per enclosure) and the output number on the particular card.

Default: 00/00/00 (no process current circuit is assigned to this channel)

Number entry required:

Format: AA/BB/CC

Range: 00- disabled; AA- 1-4, BB- 1-4, CC- 1-4 or 1-8

AA- represents the particular Auxiliary Output Enclosure Address

BB- represents the particular card position of the Auxiliary Output Enclosure

CC- represents the particular output on the card within the Auxiliary Output

Screen 1	<div style="border: 1px solid black; padding: 2px;"> ##/CP15 mAout→Chnl +Link AA/BB/CC 1/1 </div>
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CP16: Process Current Set Value (INACTIVE IN RDU)

Definition: Permits user to force process current output to the value entered. Useful for testing communication between the HMI and Auxiliary Output Enclosure and for simulating process current condition for further evaluation of control system. The "forced" process current value will be output to the AOE once "enter" is pressed. This value will continually be output until the HMI returns to the DSPLY mode where the process current will be updated relative to the programmed parameters and the vessel's material measurement.

Default: As Processed

Menu Selection required:

- 1) As Processed: Is a null command which will do nothing if selected. Is included as a selection (and as default) to protect operator from inadvertent process current setting.
- 2) Set to: XX.XXmA (00.00mA through 25.00mA)

Screen 1	<div style="border: 1px solid black; padding: 2px;"> ##/CP16 mA Value +As Processed 1/2 </div>	Screen 2	<div style="border: 1px solid black; padding: 2px;"> ##/CP16 mA Value -Set to ##.## 2/2 </div>
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CP17: Process Current 4mA Offset (INACTIVE IN RDU)

Definition: Permits user to trim the 4mA output to match the precise measurement found at a particular analog output. This function in essence is an electronic potentiometer which eliminates the need for adjustments within the Auxiliary Output Enclosure. This offset does not affect the 20mA value. The output is adjustable +/- 1mA. The value representing 4mA with selected offset is sent to the associated analog output when "enter" is pressed and is held there until another offset value is entered or upon return to the "DSPLY" mode. The offset value is held in non-volatile memory and is used in all calculations of the analog output.

Default: 40 (unitless, each digit representing roughly a 0.024mA step)

Number entry required:

Format: ##.

Range: 0-80 (representing -1mA to +1mA)

Screen 1 ##/CP17 4mA Offset
 + ## (40 norm) 1/1

CP18: Process Current 20mA Offset (INACTIVE IN RDU)

Definition: Permits user to trim the 20mA output to match the precise measurement found at a particular analog output. This function in essence is an electronic potentiometer which eliminates the need for adjustments within the Auxiliary Output Enclosure. This offset does not affect the 4mA value. The output is adjustable +/- 1mA. The value representing 20mA with the selected offset is sent to the associated analog output when "enter" is pressed and is held there until another offset value is entered or upon return to the "DSPLY" mode. The offset value is held in non-volatile memory and is used in all calculations of the analog output.

Default: 40 (unitless, each digit representing roughly a 0.024mA step)

Number entry required:

Format: ##.

Range: 0-80 (representing -1mA to +1mA)

Screen 1 ##/CP18 20mA Offset
 + ## (40 norm) 1/1

CP19: Process Current Failure Mode (INACTIVE IN RDU)

Definition: Selects the method the assigned process current output will respond when an error is detected. An error could be caused by a system failure (communication breakage) or channel failure (characteristic of sensor operation which is communicated via data link). Unprogrammed parameters for the 4mA and 20mA values shall be considered an error.

Default: 2mA fixed

Menu selection required:

- 1) 2mA fixed: Upon error detection, process current will be forced to 2mA until detected error is corrected. Normal operation will output value of current measurement.
- 2) 23mA fixed: Upon error detection, process current will be forced to 23mA until detected error is corrected. Normal operation will output value of current measurement.
- 3) Ignore error: Output value will continue to be processed independent of any error detection.

Screen 1 ##/CP19 mA FailMode
 +2mA fixed 1/3

Screen 2 ##/CP19 mA FailMode
 -23mA fixed 2/3

Screen 3 ##/CP19 mA FailMode
 -Ignore error 3/3

CP20: RelayA Circuit/Channel Link (INACTIVE IN RDU)

Definition: Permits user to assign a particular relay output to the channel displayed. The ability to independently assign relay circuits to particular channels eliminates the need to buy more outputs than required and gives complete freedom from hardware constraints when assigning channel numbers to particular sensors. Linking requires associating a channel with an Auxiliary Output Enclosure (up to four can be added), the card position in the Auxiliary Output Enclosure (up to four per enclosure) and the output number on the particular card.

Default: 00/00/00 (no relay circuit is assigned to this channel)

Number entry required:

Format: AA/BB/CC

Range: 00- disabled; AA- 1-4, BB- 1-4, CC- 1-4 or 1-8

AA- represents the particular Auxiliary Output Enclosure (AOE)

BB- represents the particular card position within the AOE

CC- represents the particular output on the card within the AOE

Screen 1 ##/CP20 RelayA→Chnl
 +Link AA/BB/CC 1/1

CP21: RelayA Set State (INACTIVE IN RDU)

Definition: Permits user to force this channel's relay output A to "on" or "off" status. Useful for testing communication between the HMI and Auxiliary Output Enclosure and for simulating relay condition for further evaluation of control system. The "forced" RelayA state will be output to the AOE once "enter" is pressed. This state will continually be output until the HMI returns to the DSPLY mode where the RelayA state will be updated relative to the programmed parameters and the vessel's material measurement.

Default: As Processed

Menu selection required:

- 1) As Processed: Is a null command which will do nothing if selected. Is included as a selection (and as default) to protect operator from inadvertent relay setting.
- 2) Relay A "on": Forces relay A output to be energized
- 3) Relay A "off": Forces relay A output to be de-energized.

Screen 1	##/CP21 RelayA State +As Processed 1/3	Screen 2	##/CP21 RelayA State -RelayA "on" 2/3
Screen 3	##/CP21 RelayA State -RelayA "off" 3/3		

CP22: RelayA Calculation Mode (INACTIVE IN RDU)

Definition: Selects from what basis the relay state is made. The selection will automatically assign appropriate units to the channel reference value parameters.

Default: Level

Menu selection required:

- 1) Level: Relay state based on material height in vessel.
- 2) Volume: Relay state based on volumetric values.
- 3) Weight: Relay state based on weight values
- 4) Percentage: Relay state based on percentage value (which is based on mA/% mode and the values given to the 4mA/0% and 20mA/100% values)
- 5) Distance: Relay state based on distance traveled from mounting point

Screen 1	##/CP22 RelayA Mode +Level 1/5	Screen 2	##/CP22 RelayA Mode -Volume 2/5
Screen 3	##/CP22 RelayA Mode -Weight 3/5	Screen 4	##/CP22 RelayA Mode -Percentage 4/5
Screen 5	##/CP22 RelayA Mode -Distance 5/5		

CP23: RelayA Function (INACTIVE IN RDU)

Definition: Selects how the relay will respond throughout the measurement range. The values which cause the relay state to change are entered in later channel parameters. Unprogrammed relay circuits will cause relays to default as de-energized regardless of this setting.

Default: Inactive

Menu selection required:

- 1) Inactive: Relay will remain de-energized regardless of programmed setpoints.
- 2) Fail on: Relay will energize upon error detection. In normal operation relay is de-energized
- 3) Fail off: Relay will de-energize upon error detection. In normal operation relay is energized
- 4) Threshold on: Relay will energize when measurement value is equal to or greater than the programmed value #1 (see parameter CP24). Relay will de-energize when measurement value is less than programmed value #1 (see parameter CP24).
- 5) Threshold off: Relay will de-energize when measurement value is equal to or greater than the programmed value #1 (see parameter CP24). Relay will energize when measurement value is less than programmed value #1 (see parameter CP24).
- 6) Window on: Relay will energize when measurement value is equal or between programmed value #1 and programmed value #2. Relay will be de-energized otherwise.
- 7) Window off: Relay will de-energize when measurement value is equal or between programmed value #1 and programmed value #2. Relay will be energized otherwise.
- 8) Pump control: Relay will energize when measurement value equals programmed value #1 and will remain energized until the measurement reaches programmed value #2 at which time the relay will de-energize. The relay will remain de-energized until the measurement value once again equals programmed value #1, thereby repeating the control sequence.

Screen 1	##/CP23 RelayA Func +Inactive 1/8	Screen 2	##/CP23 RelayA Func -Fail on 2/8
Screen 3	##/CP23 RelayA Func -Fail off 3/8	Screen 4	##/CP23 RelayA Func -Thrshld on 4/8
Screen 5	##/CP23 RelayA Func -Thrshld off 5/8	Screen 6	##/CP23 RelayA Func -Window on 6/8
Screen 7	##/CP23 RelayA Func -Window off 7/8	Screen 8	##/CP23 RelayA Func -Pump Cntrl 8/8

CP24: RelayA Reference Value 1 (INACTIVE IN RDU)

Definition: Assigns the measurement value that will be referenced by the HMI to determine what state RelayA should be in accordance to the function selected. This value is required for the threshold, window and pump control functions. The units displayed in this screen are dependent on three system parameters Units-system, Units-volume, Units-weight and channel parameter RelayA Calculation mode. The entry field size can accommodate seven digits.

Default: 0, for all units (English or Metric)

Number entry required:

Range: 999.99 for ft or m or %, 9999999 for all others.

	English	Metric
Screen 1	##/CP24 RelayA VI#1 + ###.## ft 1/1	##/CP24 RelayA VI#1 + ##.## m 1/1
	OR	OR
Screen 1	##/CP24 RelayA VI#1 +##### ft3 1/1	##/CP24 RelayA VI#1 +##### m3 1/1
	OR	OR
Screen 1	##/CP24 RelayA VI#1 +##### bu 1/1	##/CP24 RelayA VI#1 +##### bu 1/1
	OR	OR
Screen 1	##/CP24 RelayA VI#1 +##### gal 1/1	##/CP24 RelayA VI#1 +##### l 1/1
	OR	OR
Screen 1	##/CP24 RelayA VI#1 +##### lb 1/1	##/CP24 RelayA VI#1 +##### kg 1/1
	OR	OR
Screen 1	##/CP24 RelayA VI#1 +##### tn 1/1	##/CP24 RelayA VI#1 +##### t 1/1
	OR	OR
Screen 1	##/CP24 RelayA VI#1 + ###.## % 1/1	##/CP24 RelayA VI#1 + ###.## % 1/1

CP25: RelayA Reference Value 2 (INACTIVE IN RDU)

Definition: Assigns the measurement value that will be referenced by the HMI to determine what state RelayA should be in accordance to the function selected. This value is required for only the window and pump control functions. The units displayed in this screen are dependent on three system parameters Units-system, Units-volume, Units-weight and channel parameter RelayA Calculation mode. The entry field size can accommodate seven digits.

Default: 0, for all units (English or Metric)

Number entry required:

Range: 999.99 for ft or m or %, 9999999 for all others.

	English	Metric
Screen 1	<input type="text" value="##/CP25 RelayA VI#2
+ ###.## ft 1/1"/>	<input type="text" value="##/CP25 RelayA VI#2
+ ###.## m 1/1"/>
	OR	OR
Screen 1	<input type="text" value="##/CP25 RelayA VI#2
+##### ft3 1/1"/>	<input type="text" value="##/CP25 RelayA VI#2
+##### m3 1/1"/>
	OR	OR
Screen 1	<input type="text" value="##/CP25 RelayA VI#2
+##### bu 1/1"/>	<input type="text" value="##/CP25 RelayA VI#2
+##### bu 1/1"/>
	OR	OR
Screen 1	<input type="text" value="##/CP25 RelayA VI#2
+##### gal 1/1"/>	<input type="text" value="##/CP25 RelayA VI#2
+##### l 1/1"/>
	OR	OR
Screen 1	<input type="text" value="##/CP25 RelayA VI#2
+##### lb 1/1"/>	<input type="text" value="##/CP25 RelayA VI#2
+##### kg 1/1"/>
	OR	OR
Screen 1	<input type="text" value="##/CP25 RelayA VI#2
+##### tn 1/1"/>	<input type="text" value="##/CP25 RelayA VI#2
+##### t 1/1"/>
	OR	OR
	English	Metric
Screen 1	<input type="text" value="##/CP25 RelayA VI#2
+ ###.## % 1/1"/>	<input type="text" value="##/CP25 RelayA VI#2
+ ###.## % 1/1"/>

CP26: RelayB Circuit/Channel Link (INACTIVE IN RDU)

Definition: Permits user to assign a particular relay output to the channel displayed. The ability to independently assign relay circuits to particular channels eliminates the need to buy more outputs than required and gives complete freedom from hardware constraints when assigning channel numbers to particular sensors. Linking requires associating a channel with an Auxiliary Output Enclosure (up to four can be added), the card position in the Auxiliary Output Enclosure (up to four per enclosure) and the output number on the particular card.

Default: 00/00/00 (no relay circuit is assigned to this channel)

Number entry required:

Format: AA/BB/CC

Range: 00- disabled; AA- 1-4, BB- 1-4, CC- 1-4 or 1-8

AA- represents the particular Auxiliary Output Enclosure (AOE)

BB- represents the particular card position within the AOE

CC- represents the particular output on the card within the AOE

Screen 1	<input type="text" value="##/CP26 RelayB Chnl
+Link AA/BB/CC 1/1"/>
----------	---

CP27: RelayB Set State (INACTIVE IN RDU)

Definition: Permits user to force this channel's relay output B to "on" or "off" status. Useful for testing communication between the HMI and Auxiliary Output Enclosure and for simulating relay condition for further evaluation of control system. The "forced" RelayB state will be output to the AOE once "enter" is pressed. This state will continually be output until the HMI returns to the DSPLY mode where the RelayB state will be updated relative to the programmed parameters and the vessel's material measurement.

Default: As Processed

Menu selection required:

- 1) **As Processed:** Is a null command which will do nothing if selected. Is included as a selection (and as default) to protect operator from inadvertent relay setting.
- 2) **Relay B "on":** Forces relay A output to be energized
- 3) **Relay B "off":** Forces relay A output to be de-energized.

Screen 1	##/CP27 RelayB State +As Processed 1/3	Screen 2	##/CP27 RelayB State -RelayB "on" 2/3
Screen 3	##/CP27 RelayB State -RelayB "off" 3/3		

CP28: RelayB Calculation Mode (INACTIVE IN RDU)

Definition: Selects from what basis the relay state is made. The selection will automatically assign appropriate units to the channel reference value parameters.

Default: Level

Menu selection required:

- 1) **Level:** Relay state based on material height in vessel.
- 2) **Volume:** Relay state based on volumetric values.
- 3) **Weight:** Relay state based on weight values
- 4) **Percentage:** Relay state based on percentage value (which is based on mA/% mode and the values given to the 4mA/0% and 20mA/100% values)
- 5) **Distance:** Relay state based on distance traveled from mounting point

Screen 1	##/CP28 RelayB Mode +Level 1/5	Screen 2	##/CP28 RelayB Mode -Volume 2/5
Screen 3	##/CP28 RelayB Mode -Weight 3/5	Screen 4	##/CP28 RelayB Mode -Percentage 4/5
Screen 5	##/CP28 RelayB Mode -Distance 5/5		

CP29: RelayB Function (INACTIVE IN RDU)

Definition: Selects how the relay will respond throughout the measurement range. The values which cause the relay state to change are entered in later channel parameters. Unprogrammed relay circuits will cause relays to default as de-energized regardless of this setting.

Default: Inactive

Menu selection required:

- 1) **Inactive:** Relay will remain de-energized regardless of programmed setpoints.
- 2) **Fail on:** Relay will energize upon error detection. In normal operation relay is de-energized
- 3) **Fail off:** Relay will de-energize upon error detection. In normal operation relay is energized
- 4) **Threshold on:** Relay will energize when measurement value is equal to or greater than the programmed value #1 (see parameter CP30). Relay will de-energize when measurement value is less than programmed value #1 (see parameter CP30).
- 5) **Threshold off:** Relay will de-energize when measurement value is equal to or greater than the programmed value #1 (see parameter CP30). Relay will energize when measurement value is less than programmed value #1 (see parameter CP30).
- 6) **Window on:** Relay will energize when measurement value is between programmed value #1 and programmed value #2. Relay will be de-energized otherwise.
- 7) **Window off:** Relay will de-energize when measurement value is between programmed value #1 and programmed value #2. Relay will be energized otherwise.
- 8) **Pump control:** Relay will energize when measurement value equals programmed value #1 and will remain energized until the measurement reaches programmed value #2 at which time the relay will de-energize. The relay will remain de-energized until the measurement value once again equals programmed value #1, thereby repeating the control sequence.

Screen 1	##/CP29 RelayB Func +Inactive 1/8	Screen 2	##/CP29 RelayB Func -Fail on 2/8
Screen 3	##/CP29 RelayB Func -Fail off 3/8	Screen 4	##/CP29 RelayB Func -Thrshld on 4/8
Screen 5	##/CP29 RelayB Func -Thrshld off 5/8	Screen 6	##/CP29 RelayB Func -Window on 6/8
Screen 7	##/CP29 RelayB Func -Window off 7/8	Screen 8	##/CP29 RelayB Func -Pump Cntrl 8/8

CP30: RelayB Reference Value 1 (INACTIVE IN RDU)

Definition: Assigns the measurement value that will be referenced by the HMI to determine what state RelayA should be in accordance to the function selected. This value is required for the threshold, window and pump control functions. The units displayed in this screen are dependent on three system parameters Units-system, Units-volume, Units-weight and channel parameter RelayB Calculation mode. The entry field size can accommodate seven digits.

Default: 0, for all units (English or Metric)

Number entry required:

Range: 999.99 for ft or m or %, 9999999 for all others.

	English	Metric
Screen 1	##/CP30 RelayB VI#1 + ###.## ft 1/1	##/CP30 RelayB VI#1 + ##.## m 1/1
	OR	OR
Screen 1	##/CP31 RelayB VI#1 +##### ft3 1/1	##/CP30 RelayB VI#1 +##### m3 1/1
	OR	OR
Screen 1	##/CP31 RelayB VI#1 +##### bu 1/1	##/CP30 RelayB VI#1 +##### bu 1/1
	OR	OR
Screen 1	##/CP31 RelayB VI#1 +##### gal 1/1	##/CP30 RelayB VI#1 +##### l 1/1
	OR	OR
Screen 1	##/CP31 RelayB VI#1 +##### lb 1/1	##/CP30 RelayB VI#1 +##### kg 1/1
	OR	OR
Screen 1	##/CP31 RelayB VI#1 +##### tn 1/1	##/CP30 RelayB VI#1 +##### t 1/1
	OR	OR
Screen 1	##/CP31 RelayB VI#1 + ###.## % 1/1	##/CP30 RelayB VI#1 + ###.## % 1/1

CP31: RelayB Reference Value 2 (INACTIVE IN RDU)

Definition: Assigns the measurement value that will be referenced by the HMI to determine what state RelayA should be in accordance to the function selected. This value is required for only the window and pump control functions. The units displayed in this screen are dependent on three system parameters Units-system, Units-volume, Units-weight and channel parameter RelayB Calculation mode. The entry field size can accommodate seven digits.

Default: 0, for all units (English or Metric)

Number entry required:

Range: 999.99 for ft or m or %, 9999999 for all others.

	English	Metric
Screen 1	##/CP31 RelayB VI#2 + ###.## ft 1/1	##/CP31 RelayB VI#2 + ##.## m 1/1
	OR	OR
Screen 1	##/CP31 RelayB VI#2 +##### ft3 1/1	##/CP31 RelayB VI#2 +##### m3 1/1
	OR	OR
Screen 1	##/CP31 RelayB VI#2 +##### bu 1/1	##/CP31 RelayB VI#2 +##### bu 1/1
	OR	OR
Screen 1	##/CP31 RelayB VI#2 +##### gal 1/1	##/CP31 RelayB VI#2 +##### l 1/1
	OR	OR
Screen 1	##/CP31 RelayB VI#2 +##### lb 1/1	##/CP31 RelayB VI#2 +##### kg 1/1
	OR	OR
Screen 1	##/CP31 RelayB VI#2 +##### tn 1/1	##/CP31 RelayB VI#2 +##### t 1/1
	OR	OR
Screen 1	##/CP31 RelayB VI#2 + ###.## % 1/1	##/CP31 RelayB VI#2 + ###.## % 1/1

CP32: View Sensor Diagnostics (INACTIVE IN RDU)

Definition: Permits user to view various sensor diagnostic conditions primarily used in the troubleshooting process. Since this parameter must request information via digital communications from the sensor, the data will be displayed only after the selection has been made and "enter" has been pressed. If particular selection screen is exited, upon return information will be lost and "*****" will reappear. Selection must be re-entered to prompt communication again. The leading character "-" will change to "+" when data is displayed. Otherwise "-" is shown and "No Request" will indicate "+".

Default: No Request

Menu selection required:

- 1) No Request: Is a null command which will do nothing if selected. Is included as a selection to protect HMI from requesting information from sensor when not really wanted.
- 2) Version: If selected, HMI will request sensor software version "ID" code from sensor and display such. Useful for verifying revision level in sensor. Format is V#.##.
- 3) Cycles: If selected, HMI will request total number of cycles accumulated by sensor throughout its life. Useful for assessing operational life and planning preventive maintenance. Maximum displayable cycles will be 999999.
- 4) Errors: If selected, HMI will request total number of errors accumulated by sensor throughout its life. Useful for assessing reliability of sensor in the particular application. Maximum displayable error count will be 9999.

Screen 1

##/CP32 Sensr Diag +No Request 1/4

Screen 2

##/CP32 Sensr Diag -Sftwre **** 2/4
--

Screen 3

##/CP32 Sensr Diag -Cycles ***** 3/4

Screen 4

##/CP32 Sensr Diag -Errors **** 4/4
--

TROUBLESHOOTING

PROBLEM: HMI reports a "Com Error" on a specific channel

CAUSE/SOLUTION:

- 1) This error is caused by the inability of the HMI to receive a return response from an SMU
- 2) Disable channel status parameter (CP01) if no SMU is intended for the HMI channel
- 3) Verify the SMU's network address corresponds to the HMI channel number.
- 4) Verify that each SMU on the network has a unique address selection.
- 5) Verify electrical power is connected to the SMU.
- 6) Verify polarity of the communication connection.

PROBLEM: HMI reports a "Return Error" on a specific channel

CAUSE/SOLUTION:

- 1) This error is caused by the measurement of downward travel being greater than the upward travel.
- 2) Determine if error is repeatable by taking multiple measurements. If an "Motion Error" is subsequently detected, see troubleshooting regarding such. Otherwise, continue on below.
- 3) Observe the actual motion of the plumb bob. Ensure no physical objects are impeding full return.
- 4) If travel of plumb bob is normal, the interrupters on the encoder PCB could be contaminated.
- 5) If travel of plumb bob does not permit return to home position, verify that the wiper seal is not fouled with material. Excessive drag on cable can cause premature cycle stoppage.

PROBLEM: HMI reports a "Index Error" on a specific channel

CAUSE/SOLUTION:

- 1) This error is caused by the measurement of upward travel being greater than the downward travel.
- 2) Determine if error is repeatable by taking multiple measurements. It is fairly unlikely that "Index Errors" will occur back-to-back. These errors will normally be in tandem with "Return Errors".
- 3) Observe the actual motion of the plumb bob. Insure no physical objects could give a false starting point to the plumb bob.
- 4) If travel of plumb bob is normal, the interrupters on the encoder PCB could be contaminated.

PROBLEM: HMI reports a "Motion Error" on a specific channel

CAUSE/SOLUTION:

- 1) This error is caused by the inability of the plumb bob to move when requested by the SMU
- 2) Determine if error is repeatable by taking multiple measurements. Error could be caused by a broken cable, stuck plumb bob in material, frozen plumb bob to flange, material packed immediately below the plumb bob, or some damaged electronic circuitry in the motor driver region. Resolve obvious problem or consult factory for electronic troubleshooting or replacement.
- 3) Observe the actual motion of the plumb bob. Verify that the wiper seal is not fouled with material. Excessive drag on cable can cause premature plumb bob reversing and cycle stoppage.

PROBLEM: Measurement readings continuously indicate an incorrect, repeatable distance

CAUSE/SOLUTION:

- 1) Verify cable length installed on SMU. A cable which is too short will cause automatic reversing of SMU prior to contact with material. Replace cable with a longer more suitable length if necessary.
- 2) Cable may not be passing freely through cable wiper seal assembly due to imperfection in cable (such as a cut in jacketing or kink in cable). Could also be caused by fouling of cable with material. Inspect cable and clean, repair or replace as needed.

BULLETIN 344B

SAFETY

⚠ General Safety

CAUTION: It is essential that all instructions in this manual be followed to ensure proper operation of the equipment and safety of operating personnel. The use of this symbol is used throughout this manual to highlight important safety issues. Please pay particular attention to these items.

⚠ Electrical Shock Caution

HMI/RDU is powered with HIGH VOLTAGE. No operator serviceable parts are inside. All servicing is to be performed by qualified personnel. Each HMI/RDU is provided with a "protective conductor terminal" \ominus which shall be terminated to earth ground potential (see Electrical Installation). This product's design complies with EN61010-1 installation category II and pollution degree 2.

Electromagnetic Compatibility (EMC)

The HMI/RDU was tested and found to comply with the standards listed below. The HMI/RDU should not be used in residential or commercial environments. Compliance to the EMC standards was demonstrated by means of a test setup using the following installation methods.

- 1) HMI/RDU enclosure was connected to earth ground (protective earth) \ominus .
- 2) Shielded cable was used to interconnect the RS-485 network (connections D+ and D-). The shield drain was connected to earth ground (SHD terminal) at each end.

EMC Emissions:

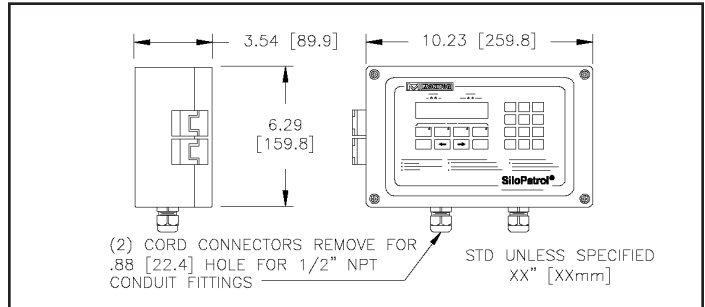
Meets EN 61326-1	Electrical Equipment for Control Use, EMC
EN 55011	Radiated and conducted emissions (Class A- industrial)
EN 61000-3	Fluctuation/Flicker
Meets FCC Part 15B	RF Devices, Unintentional Radiators
CISPR 11	Radiated and conducted emissions (Class A- industrial)

EMC Immunity:

Meets EN 61326-1	Electrical Equipment for Control Use, EMC
IEC 1000-4-2	Electrostatic discharge (industrial)
IEC 1000-4-3	RF radiated EM fields (industrial)
IEC 1000-4-4	Electrical fast transients (industrial)
IEC 1000-4-5	Electrical surges (industrial)
IEC 1000-4-6	RF conducted EM energy (industrial)
IEC 1000-4-8	Power frequency magnetic fields (industrial)
IEC 1000-4-11	Source voltage deviation

MECHANICALS

DIMENSIONS ARE SHOWN IN INCHES WITH MILLIMETER EQUIVALENT IN BRACKETS



SPECIFICATIONS

Human Machine Interface (HMI)

Power Requirements:	115 VAC or 230 VAC, 50/60 Hz
Power Consumption:	10 VA max
Operating Temperature:	-4° F to 131° F (-20° C to 55° C)
Sensor Communication:	RS-485 half-duplex, non-isolated, proprietary protocol
Channels:	2, 8 or 16
Display:	2-lines by 20-characters .22" x .12" characters, LCD backlight
Keypad:	20 keys
Indicators:	8 LEDs (function, relay, error status)
Enclosure (HxWxD):	Pntd Alum.; 6.29" x 10.23" x 3.54"
Certifications/Protection:	NEMA 4, IP66; CE Mark

Remote Display Unit (RDU)

Power Requirements:	115 VAC or 230 VAC, 50/60 Hz
Power Consumption:	10 VA max
Operating Temperature:	-4° F to 131° F (-20° C to 55° C)
Communication with HMI:	RS-485 half-duplex, isolated, proprietary protocol
Channels:	16
Display:	2-lines by 20-characters
Keypad:	20 keys
Indicators:	8 LEDs (function, relay and error status)
Enclosure (HxWxD):	Pntd Alum.; 6.29" x 10.23" x 3.54"
Certifications/Protection:	NEMA 4, IP66; CE Mark

WARRANTY

Monitor Technologies LLC warrants each **SiloPatrol**[®] inventory monitoring system it manufactures to be free from defects in material and workmanship under normal use and service for two (2) years from the date of purchase. The purchaser must give notify Monitor of any defects within the warranty period, return the product intact, and prepay transportation charges. The obligation of Monitor Technologies LLC under this warranty is limited to repair or replacement at its factory. This warranty does not apply to any product which is repaired or altered outside of Monitor Technologies' factory, or which has been subject to misuse, negligence, accident, incorrect wiring by others, or improper installation. Monitor Technologies LLC reserves the right to change the design and/or specifications without prior notice.

Monitor Technologies LLC

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