PI5600 PAYOUT INDICATOR

USER'S MANUAL

Revision 3

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TABLE OF CONTENTS

SECTION 1: GENERAL INFORMATION

INTRODUCTION

This manual provides general information, hardware description, installation instructions, operating instructions, and support information for the PI5600.

GENERAL DESCRIPTION

The PI5600 is an automated, portable device used in conjunction with a cable tow reel and a sheave with magnets implanted around its periphery. The unit measures outgoing and incoming cable length to a resolution of +.001 ft, up to a maximum of +65,501.233 ft or +19,977.876 meters, (for a magnet-spacing of 1.999 feet).

The unit is environmentally sealed and its corrosion-resistant fabrication makes it the ideal instrument for harsh environments and oceanographic applications requiring an accurate reading of the amount of cable towed behind a vessel.

FEATURES:

> Monitors cable deployment and recovery
> Provides measurements in feet or meters, and automatically converts between them
> Measures up to +65,501.233 feet or +19,977.876 meters, depending upon magnet-spacing
> Stainless steel, gasketed construction is environmentally sealed and corrosion-resistant
> Incorporates backlight in LCD for low-light viewing
> Eliminates the need for any operator calculations
> Generates audible alarms when user-specified maximum minimum payout setpoints are exceeded
> Allows the user to program maximum alarm, minimum alarm, and preset values
> Stores alarm and magnet-spacing values in non-volatile EEPROM
> Uses CMOS circuitry for low power consumption and high noise immunity
> Operates from an internal NiCd battery during AC power loss
> Supports RS-232C communications
> Uses input from either a Geoquip or Sea-Mac sheave sensor
> Allows operator to reverse rotational sense without moving sheave, when using a Geoquip sensor

SPECIFICATIONS:

Largest Indicated Values:	(+32,767) x (MS) feet (+9,993.935) x (MS) meters (Note 1)
Magnet-Spacing Resolution:	+.001 feet (Note 2)
Accuracy:	+ 1 count (Note 3)
Maximum Magnet-Spacing:	1.999 feet
Minimum Magnet-Spacing:	0.0833 feet (Note 4)
Power Requirements:	115V @ 70mA or 230V @ 35mA
Battery Type:	Varta TR7/8 (Rechargeable 9V NiCad)
Duration of Battery Operation:	10 min @ 30°C (Note 5)
Time to Fully Recharge Battery:	>14 hrs
Battery Charge Retention:	50% of Capacity After 3 mos @ 30°C
Battery Life:	2 years

Environmental Conditions:
Operating Temperature Range	0 to 45°C
Storage Temperature Range	-40 to 50°C
Relative Humidity	0 to 90% (non-condensing)

I/O Ports:
Terminal	RS-232C Compatible, 300-9600 Baud

Dimensions:
Width	8.00 in. (20.32cm)
Length	9.94 in. (25.24 cm)
Depth	4.75 in. (12.07 cm)

Net Weight:	12.3 lbs (5.6 kg)

NOTES:

1. The variable "MS" is the magnet-spacing.

2. Magnet-spacing may be entered only in feet and is assumed to be a positive value.

3. A "count" is one passage of a magnet by the sheave sensor, and is equivalent to the magnet spacing.

4. Refers to spacing between magnetic fields, as defined by their effects on the sensor.

5. Battery assumed to be fully charged.

SECTION 2: HARDWARE PREPARATION AND INSTALLATION

INTRODUCTION

This section provides unpacking instructions, installation instructions and a checkout procedure.

UNPACKING INSTRUCTIONS

Unpack the unit from the shipping container. Refer to the packing list and verify that all items are present. Save the packing material for storing or reshipping of the Unit.

NOTE: If the shipping carton is damaged upon receipt, request the carrier's agent to be present during unpacking and inspection of the PI5600.

INSTALLATION INSTRUCTIONS

1. Location of Unit:

Adequate consideration of the orientation of the PI5600 is mandatory to insure the greatest display contrast and viewing clarity.

The Unit is secured via the four mounting holes in the case to either a vertical or a horizontal mounting surface. It may be mounted either at the winch or at some remote location.

2. Adjusting LCD Contrast:

NOTE: This procedure must be performed in a clean, dry environment, preferably indoors, to avoid electrical shock.

2.1 Loosen clamps, open case lid, and locate trimpot R5(slightly above the middle of the left edge of the CPU printed circuit board, as the unit is viewed with the lid opened to the left).

2.2 Close lid, turn on power, and note current LCD contrast. Be careful to avoid any exposed terminals carrying ACpower, especially on the Power-Supply board.

2.3 Turn off power, open lid, and adjust R5.

2.4 Repeat Steps 2.2 & 2.3 until desired contrast is achieved.

2.5 Turn off power and re-fasten clamps.

3. Power Supply Connections:

A connector is provided for power and mates with the Unit's connector labeled "Power" J1. The unit is shipped with jumper settings on the Power Supply board to accommodate 115V AC @ 70 mA. However, the PI5600 may be reconfigured to accept 230V AC @ 35mA by removing the two "115V" jumpers from the Power Supply board and relocating them into the "230V" holes.

NOTE: Since shipboard power is susceptible to fluctuations and surge, it is strongly recommended that the line voltage be measured prior to applying power to the unit.

4. Remote Sensor Location:

The sheave may be mounted at any convenient location at the stern of the ship. The sensor is mounted to the sheave. Note that the sensor must be located on the side of the sheave bearing the magnets. Also, Geoquip Sensors should be oriented such that the engraved arrows point toward the sheave wheel. (See DWG# 049-1-004.) The one-hundred-foot sensor cable provided mates with a Geoquip Sensor and the "Sensor" J2 connector on the PI5600.

5. Terminal Computer I/O Connections:

The optional terminal I/O connector ("Serial Port" J3) may be used to display the PI5600's count to an external computer terminal. Connect an RS-232C-compatible cable to the mating female connector labeled on the Unit. When properly connected, the "SUBSEA " logo will be displayed on the external terminal or computer.

NOTE: The factory-set baud rate is 9600 baud, 7 data bits, no parity, and one stop bit.

6. Normal Mode vs. Sea-Mac Mode:

6.1 General Considerations:

Units with "56CX", "56D", or later CPU boards accept input from either Sea-Mac or Geoquip Sensors, and these units do not require any special configuration. In addition, these units allow the operator to use SW2 on the CPU board to reverse the sheave rotational polarity for either type of sensor.

CHECKOUT PROCEDURE

This procedure assumes that the PI5600 has been installed properly, and enables the user to verify basic operation of the PI5600.

1. Measuring Magnet-Spacing:

Before installing the sheave, use a rope of approximately the same diameter as the intended cable to determine sheave circumference in units of feet. Divide the circumference by the number of magnets implanted in the sheave, to obtain the magnet-spacing. Round the magnet-spacing to three decimal places. If possible, keep the sheave near at hand for purposes of this checkout procedure.

2. Power:

Turn the PI5600 power switch on, and verify that the display shows "+00000.000 FEET" or "+00000.000 METERS", and that the backlight in the LCD illuminates. If the PI5600 fails to perform one or both of these functions, see the "Troubleshooting" section.

Also refer to the "Troubleshooting" section if the PI5600 emits beeps and/or alternates the length-unit designation (i.e. "FEET" or "METERS") with the message "AC OFF" or "LO BAT".

3. RS-232C:

If the optional RS-232C cable is installed between a terminal and J3 of the PI5600, verify that the following data appears on the monitor screen when the PI5600 power is switched on:

A) The Subsea logo appears in the middle of the screen.

B) Data output (including payout polarity, measurement, and units) appears on the bottom line of the screen.

Note that only the data-line is re-transmitted regularly, such that the logo will appear only after the PI5600 is powered-up or reset with the RS-232C terminal already on. If the monitor display is incorrect or nonexistent, see the "Troubleshooting" section.

4. Programming:

Put the PI5600 into the "FEET" mode, and program the proper magnet-spacing and minimum and maximum alarm setpoints, as described in the Operating Instructions below. Use the "Display" functions to verify that these settings have been modified correctly.

5. Sheave Count Polarity:

The PI5600 is intended to show increasingly positive or decreasingly negative values as cable is paid out, and increasingly negative or decreasingly positive values as cable is hauled in.

If the sheave is available and properly attached to PI5600 connector J2, try turning the sheave one full rotation in the direction corresponding to outgoing cable. Verify that the display shows a "+" with the sheave's circumference. If the magnitude is incorrect, refer to "Troubleshooting". If the magnitude of the circumference is correct but the displayed sign is "-", then the sheave count polarity must be reversed. SW2 may be used to reverse sheave count polarity as follows:

Turn the power off, loosen the lid clamps, and open the lid.

Reverse the position of SW2 ("Direction"), in the lower, right-hand corner of the CPU printed circuit board, and close up the box again.

Turn the power back on, and repeat the sheave polarity test above to verify that the count polarity is now positive in the outgoing direction. Note that failing to correct a reversed sheave count polarity invalidates alarm settings, since alarms are only triggered for positive counts.

SECTION 3: OPERATING INSTRUCTIONS

INTRODUCTION

This section provides the necessary information to initialize and operate the PI5600. Information consists of the keypad control description, operating limitations, and operating procedures.

KEYPAD CONTROL DESCRIPTION

1	2	3	MUTE
4	5	6	DIS-PLAY
7	8	9	RESET
.	0	#	ENTER

DESCRIPTION	**FUNCTION KEYS**
MUTE	
FEET TO METERS	ENTER - # -1
METERS TO FEET	ENTER - # -2
SET PRESET COUNT	NUMBER-ENTER-1
SET MAXIMUM ALARM	NUMBER-ENTER-2
SET MINIMUM ALARM	NUMBER-ENTER-3
SET MAGNET-SPACING	NUMBER-ENTER-4
DISPLAY MAX ALARM	DISPLAY-2
DISPLAY MIN ALARM	DISPLAY-3
DISPLAY MAG-SPACING	DISPLAY-4
RESET PI5600	RESET-ENTER
SILENCE ALARM	MUTE

LIMITATIONS

The Unit's RS-232C I/O port is factory set for 9600 baud. This baud rate may be changed at the jumper header next to IC10. Note that the number of data bits, polarity, and the number of stop bits cannot be modified.

The Unit trades off resolution for capacity at larger magnet-spacings, and vice-versa at smaller magnet-spacings. Specifically:

Max Indicated Feet = (+32,767) x (magnet-spacing) feet

Max Indicated Meters = (+9,993.935) x (magnet-spacing) meters

After the user enters a preset value, the PI5600 enters a short period where it remains unresponsive to further input, and does not update the display. The duration of this period is directly proportional to the magnitude of the preset value. For example, a preset value between 20,000-30,000 results in a delay between 90-115 seconds, for a magnet-spacing of 0.833 feet. Smaller magnet-spacings cause longer delays, for a given preset value.If at any time a malfunction should occur, turning the power switch off and on should reset the system.

When the maximum positive payout indication is exceeded, the count rolls-over to the maximum negative indication, and becomes decreasingly negative. The converse is also true: exceeding the maximum negative value forces a roll-over to the maximum positive value.

OPERATING PROCEDURES

GENERAL:

Most of the functions above can be terminated in the middle of a key sequence by pressing "ENTER" twice, to obtain a "USER INPUT ERROR" message. The main exception is Reset, which is terminated by pressing any key except "ENTER" after pressing "RESET".

RESET:

During normal operations, if the operator desires to set the display to indicate all zeroes, pressing the key labeled "RESET"causes the display to prompt:

PRESS ENTER TO RESET

Pressing the "ENTER" key will reset the system and display all zeroes. Pressing any other key will cancel the Reset operation.

8

MUTE:

Pressing this key silences an audible alarm. The audible alarm sounds when the display count exceeds the maximum alarm count or drops below the minimum alarm count.

UNIT CONVERSION:

These two commands allow the operator to convert both the current count and the counting mode from "feet" to "meters" or vice-versa:

FEET TO METERS: ENTER-#-1

METERS TO FEET: ENTER-#-2

MAGNET-SPACING:

The magnet-spacing must be entered in feet with a 3-digit decimal point. The entry is then stored permanently in EEPROM to be viewed or modified by the user. The following key sequence stores the magnet-spacing:

STORE MAG. SPACING: NUMBER-ENTER-4

"NUMBER" is in the form "X.XXX", where X = a digit from 0 to 9. No leading zeroes are accepted. Padding zeroes must be added to 3 digits; e.g. "1.300". Entering more than 3 digits after the decimal point causes an "OVERFLOW" message. Entering more than 6 digits with a decimal point causes the PI5600 to terminate the "Store Magnet-Spacing" operation, without any changes.

MINIMUM COUNT ALARM:

A minimum count comparison function sounds an audible alarm when the amount of cable out drops below the positive value preset by the operator. The minimum count value is stored in EEPROM, and may be viewed or modified by the user. The following key sequence stores the minimum count:

MINIMUM COUNT ALARM: NUMBER-ENTER-3

"NUMBER" is in the form "XXXXX", where X = a digit from 0 to 9. No leading zeroes are accepted. Entering more than 5 digits causes an "OVERFLOW" message. Entering numbers between 65536 and 99999 causes counter wrap-around; i.e. 65536 = 1, etc. Decimal numbers will be truncated to integers. Length units are assumed to be feet.

MAXIMUM ALARM COUNT:

A maximum count comparison function sounds an audible alarm when the amount of cable out exceeds the positive value preset by the operator. The maximum count value is stored in EEPROM, and may be viewed or modified by the user. The following key sequence stores the maximum count:

MAXIMUM COUNT ALARM: NUMBER-ENTER-2

"NUMBER" is in the form "XXXXX", where X = a digit from 0 to 9. No leading zeroes are accepted. Entering more than 5 digits causes an "OVERFLOW" message. Entering numbers between 65536 and 99999 causes counter wrap-around; i.e. 65536 = 1, etc. Decimal numbers will be truncated to integers. Length units are assumed to be feet.

 DISPLAY EEPROM CONTENTS:

To view the magnet-spacing or an alarm setting, press one of the following:

DISPLAY MAXIMUM ALARM: DISPLAY-2

DISPLAY MINIMUM ALARM: DISPLAY-3

DISPLAY MAG. SPACING: DISPLAY-4

PRESET COUNT:

To preset a count press the following:

PRESET COUNT: NUMBER-ENTER-1

"NUMBER" consists of up to 6 digits and a decimal point for decimal numbers, or up to 5 digits for an integer, where:

1) Decimal numbers may have from 1 to 3 digits to the right of the decimal.

2) Entering numbers which exceed the maximum indicated value
(for the current magnet-spacing) gives unpredictable results, and should be avoided.
3) Negative presets cannot be entered.

4) Length units are assumed to be feet.

Note: The larger the preset value, the longer the delay before the PI5600 can begin operation after a preset. For example, presetting to a value of 20,000 ft locks up the PI5600 for about 90 sec, for a magnet-spacing of 0.833 ft. Smaller magnet-spacings cause longer delays, for a given preset value.

SECTION 4: TROUBLESHOOTING

1. SHEAVE ROTATION CAUSES ERRORS:

1.1 Symptoms:

    a.   Each magnet-pass or turn of the sheave causes the PI5600 to display changes in length which are incorrect, whether or not the correct magnet-spacing has been programmed into the Unit.

1.2 Probable Causes:

    a.   Brand new MCU installed: The EEPROM storage for the magnet-spacing parameter is located inside the MCU chip (68HC11A1). A new chip will contain indeterminate data in the memory locations for magnet-spacing, minimum alarm and maximum alarm.

        NOTE: Do not attempt replace 68HC11AN MCU with a newer 68HC11EN MCU. The EPROM program must also be changed.

    b.   EEPROM corrupted: Strong power surges and/or static electrical ischarges inside the box may be able to corrupt the magnet-spacing, minimum alarm and maximum alarm data.

1.3 Solutions:

    a.   Turn power on.

    b.   Put PI5600 into "Feet" mode (Enter + # + 2).

    c.   Program magnet-spacing, minimum alarm, and maximum alarm into PI5600. Remember that all three parameters are in feet.

    d.   Push the "Reset" button on the keyboard, and then push "Enter".

    e.   Use the "Display" functions to verify that desired parameters have been stored.

    f.   You may now operate the PI5600 in either the "Feet" or "Meters" mode.

2. NO AC POWER TO PI5600

2.1 Symptoms:

    a.   When power is switched on, LCD shows nothing, or displays characters, but backlight remains unlit.

b.   If characters are displayed, length-unit designation (i.e. "FEET" or "METERS") alternates with the message "AC OFF".

2.2 Probable Causes:

a.   Power cord (to J1) unplugged at one or both ends.

b.   Power cord has one or more broken conductors or connector pins.

c.   Fuse is blown. (Fuse is 0.25A, 250V, and is located on power supply board.)

2.3 Solutions: Self-explanatory.

3. LOW BATTERY CHARGE:

3.1 Symptoms:

a.   When power is switched on, length-unit designation (i.e. "FEET" or "METERS") alternates with the message "LO BAT".

b.   When power cord is disconnected with PI5600 still activated, LCD characters either fade out, or "LO BAT" message alternates with length-unit designation.

3.2 Probable Cause:

a.   Battery is discharged or defective.

3.3 Solution:

a.   Leave power cord attached to PI5600, and leave power switch on, for about 24 hrs., to allow battery to charge.

b.   If "LO BAT" message persists, and/or characters fade from LCD when power cord is unplugged, replace battery.

4. MONITOR OUTPUT GARBLED OR NONEXISTENT:

4.1 Symptoms:

a.   Data displayed on a monitor connected to J3 of PI5600, via optional cable, appears garbled or does not appear.

4.2 Probable Causes:

   a.   Mismatches exist between the monitor and the PI5600 settings
        for baud rate, number of data bits, parity, and/or number of stop bits.

   b.   RS-232C cable is unplugged at one or both ends.

   c.   RS-232C cable has one or more broken conductors or connector pins.

   d.   Transmit and receive lines in RS-232C cable need to be reversed.

4.3 Solutions:

   a.   Mismatches:

        1)   Baud Rate: Factory-set to 9600 baud, but may be adjusted on
             jumper header next to IC10 on CPU PC board. Baud rates
             available are silk-screened next to corresponding jumper pins.

        2)   Data Bits: 7, unchangeable

        3)   Parity: none, unchangeable

        4)   Stop Bits: 1, unchangeable

   b.   RS-232 Cord Loose or Broken: Check, tighten, and/or repair.

   c.   Transmit/Receive Line Reversal:

        1)   The PI5600 transmits data on pin 3 of the DB-25 and the DE-9.

        2)   Determine whether the monitor receives its data on pin 2 or pin
             3, and swap these pins in the DB-25 or DE-9 if necessary.

5. SHEAVE JITTER CAUSES COUNTING:

5.1 Symptoms:

   a.   Boat motion relative to towfish causes sheave to rock a magnet back
        and forth across the sensor, such that the payout indicator shows a net
        increase or decrease.

5.2 Probable Causes:

   a.   CPU board in Unit is "56B" or "56C".

   b.   SW1 ("Filter") in lower, right-hand corner of CPU PCB is "In".

5.3 Solutions:

    a.   Reposition sheave wheel such that no magnets are directly above the sensor box.

    b.   Change SW1 to "Out".

    c.   Obtain upgrade to "56CX" CPU board.

6. SHEAVE COUNT POLARITY REVERSED:

6.1 Symptoms:

    a.   Outgoing cable causes increasingly negative or decreasingly positive values to be displayed.

    b.   Incoming cable causes increasingly positive or decreasingly negative values to be displayed.

6.2 Probable Causes:

    a.   Sheave is reverse-mounted.

6.3 Solution:

    a.   Follow instructions in "Checkout Procedure", Step 5.

SECTION 5: SOFTWARE ERRATA

Version: 1.0

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1) Maximum and minimum alarms can be set to values exceeding the maximum indicated value for a given magnet-spacing (e.g. 32,767 feet for MS = 1.000 ft). However, the PI5600 will not measure payouts above this maximum. Thus, alarm setpoints above the maximum indicated value and below 65,536 feet will never be triggered. The PI5600 appears to accept alarm setpoints of 65,536 to 99,999 feet, but in fact the Unit "rolls-over" these setpoints. Specifically, attempting to set the max alarm to 65,536 feet actually sets it to 1 foot, while 65,537 feet rolls over to 2 feet, etc. Attempting to enter 100,000 feet or more results in an overflow error message and termination of alarm setpoint entry.

2) The "INPUT OVERFLOW" error message is actually displayed as "INPUOVERFLOW".

3) Although the PI5600 will accept magnet-spacings greater than 1.999 ft, its behavior at indicated values greater than 32,767 ft is unpredictable. Unusual behavior includes periodic beeping and nonsense indicated values. Avoid using magnet-spacings greater than 1.999 ft.

4) Attempting to preset the PI5600 to a value greater than the maximum indicated value for the current magnet-spacing yields unpredictable results. The displayed value may have rolled-over through either the positive or negative maximum value, or the system may lock up and emit a continuous buzzing tone. Do not try to preset to a value greater than the current maximum indicated value.

5) The Preset function is intended to preset the PI5600 counters to the number of counts corresponding to the payout length closest to the length desired by the user. However, the Preset function usually errs by +1 magnet-spacing. For example, for a magnet-spacing of .833 and a preset of 1000, the correct preset would be either 999.600 or 1000.433. The actual preset value is 1001.266. To obtain a more accurate preset, subtract one magnet-spacing from the desired preset value, and enter this reduced number. You may need to round the reduced preset to allow complete entry, since the Preset operation automatically terminates when more than six digits and a decimal point are entered.

6) Depressing the "." key six times in a row causes the PI5600 to lock up, such that the only way to reset it is to turn the power off and then on.

7) Whenever a "." should appear at the fifth data-character location in the data-entry "screen", a ":" actually appears. For example, "INPUT:1000:00".

8) Maximum and minimum alarm set points may be entered with one to three digits to the right of a decimal point (up to a total of 6 digits and one decimal point). However, the PI5600 ignores all digits to the right of the decimal point, and truncates to an integer. Future versions will not allow entry of a decimal point.

9) Sometimes, presetting the PI5600 to a value exceeding the maximum alarm value triggers the alarm, and sometimes it does not.

Version 2.0

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1) Change software to reflect upgrade in CPU from 68HC11AN (now obsolete) to 68HC11EN. Due to changes in register configurations, the old software will not run on the new CPU's.

SECTION 6: SCHEMATICS

IMPORTANT NOTE: These schematics are provided for reference only. Subsea Systems strongly recommends that users of the PI5600 not attempt to repair faults on either of the printed circuit boards; rather, Subsea Systems recommends replacement of faulty boards.
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