



# **INTERMEDIATE DEPTH LOGGING WINCH**

## **Operations and Maintenance Manual**

---

October 6, 2021

---

Table of Contents

1.0	Purpose .....	1
2.0	Scope .....	1
3.0	References.....	1
4.0	Definitions .....	1
5.0	Responsibilities .....	1
6.0	Safety Notice .....	2
7.0	Operator's Manual.....	3
7.1	Introduction.....	3
7.2	Assembly .....	3
7.3	Attaching Logging Tools .....	5
7.4	Controls .....	6
7.5	Operations.....	8
7.6	Storage .....	9
8.0	Appendix A: Programming the Depth/Speed Display.....	10
9.0	Appendix B: Programming the Tension display .....	11
10.0	Appendix C: Preventive Maintenance .....	12
11.0	Appendix D: Theoretical Cable Weight.....	14
12.0	Appendix E: Gearhart-Owen Cablehead.....	15
13.0	Appendix F: User Summary Sheet .....	16
14.0	Appendix G: Packing List.....	17

## 1.0 PURPOSE

The objective of this document is to provide the operator with a working knowledge of how the Intermediate Depth Logging Winch is assembled, tuned and operated.

## 2.0 SCOPE

IDP Intermediate Depth Logging Winch.

## 3.0 REFERENCES

- 3WCA1000 Winch Control Operator Manual
- WNA Winch Operator Manual
- Gemini 4000 Instruction Manual
- Model IMS Instruction Manual
- Expected Cable Weights Excel Sheet
- GO Cablehead Termination

## 4.0 DEFINITIONS

**IDP** – U.S. Ice Drilling Program, formerly IDDO.

**IDLW** – Intermediate Depth Logging Winch.

**Operator** – Any person involved in the assembly or use of the equipment described in this document.

**QAS** – Quality Assurance and Safety group.

**SSEC** – University of Wisconsin-Space Science & Engineering Center, the home of IDP.

## 5.0 RESPONSIBILITIES

**IDP Management** is responsible for ensuring that winch operators are provided with accurate, up-to-date operating procedures.

**IDP Engineering** is responsible for the creation and maintenance of this manual.

**IDLW Operators** are responsible for ensuring these procedures are followed and any safety warnings contained herein are heeded.

**SSEC QAS** is responsible for ensuring that the proper procedures of document creation, review, approval, maintenance and updating are followed.

## 6.0 SAFETY NOTICE

Only trained personnel approved by IDP should operate the Intermediate Depth Logging Winch. All operators should read and understand the following safety precautions.

### **Situational Safety**

- The IDLW system can be operated by one person, but it is highly recommended that two people are always present during operations.
- The winch and cable should be monitored at all times during operation. The winch should never be left unattended while powered on or in motion.

### **Personal Protective Equipment (PPE)**

- PPE – Workers shall wear appropriate hand, eye, and ear protection during the entire winch operations – logging, handling fluids, etc.

### **Mechanical Safety**

- Pinch Points – There are several areas on the equipment where a finger, hand, arm or clothing could be pinched. Operators should identify all pinch points prior to operation and should be mindful of all such points during operation.
- Rotating Components – Sheaves and the drum may be rotating and exposed to the operator on the surface. Keep hands, limbs, loose clothing, and hair away from any rotating components during operations.
- Eye Protection – Operation of the winch requires eye protection be worn by operators at all times.
- Burn Hazard – Avoid contact with hot components. If service is required, allow time for the components to cool.
- Cold Hazard – Metal components and drilling fluid may be extremely cold after being in the borehole. Always wear appropriate gloves when handling.
- Slippery Surfaces – Rig footing and surrounding ice may become slippery when wet with drilling fluid. Use caution whenever walking around the winch operations area.
- Overhead Masses – Equipment may be above head level. Be mindful of hazards and always work as a team when using the winch. Ensure composite toe boots are worn when suspended masses are present.

### **Electrical Safety**

- Voltage – Extreme care shall be taken when assembling, disassembling and servicing electrical equipment. Always disconnect power before servicing equipment.
- Grounding – Because the winch sits upon a large thickness of ice, a common earth ground cannot be established. Workers shall ensure that all equipment is bonded together to a common ground back to the generator.

### **Chemical Safety**

- PPE - Use fluid resistant gloves and eye protection whenever handling drilling fluid.
- Other Chemicals - Use care and observe all safety warnings when handling Ethanol and/or other chemicals.

### Environmental Safety

- Cold – This winch will be deployed to extremely cold climates. Operators shall wear outerwear suitable to protect themselves from the cold, and should monitor their own and fellow workers' activities for exposure to cold.

## 7.0 OPERATOR'S MANUAL

### 7.1 Introduction

- 7.1.1 The IDLW system is a small winch system capable of going to 1800m depth.
- 7.1.2 The IDLW system is a variation of a Mount Sopris logging system mounted onto a sled.
- 7.1.3 Mount Sopris recommends a 4kW generator for the system, with the winch normally maxing out around 2.5kW. Most logging operations will not max out the winch.

Note: Remember to take elevation into account when planning power requirements. Generators lose 3% efficiency for every 1000 ft of elevation above sea level.

- 7.1.4 The IDLW system should be operated in conjunction with a logging tool and a logging tower / tripod.

### 7.2 Assembly

#### 7.2.1 Attaching tow bars, Figure 1:

- If needed, tow bars can be attached to the sled for towing.
- Angle the tow bar in order to place its ends inside the channels of the I-beam skis.
- Align the tow bar with the circular cutouts in the skis and then insert a solid mounting bracket through the open hole on each side.
- Align the pin hole of the mounting bracket with the pinhole of the tow bar and clip a safety pin in place.

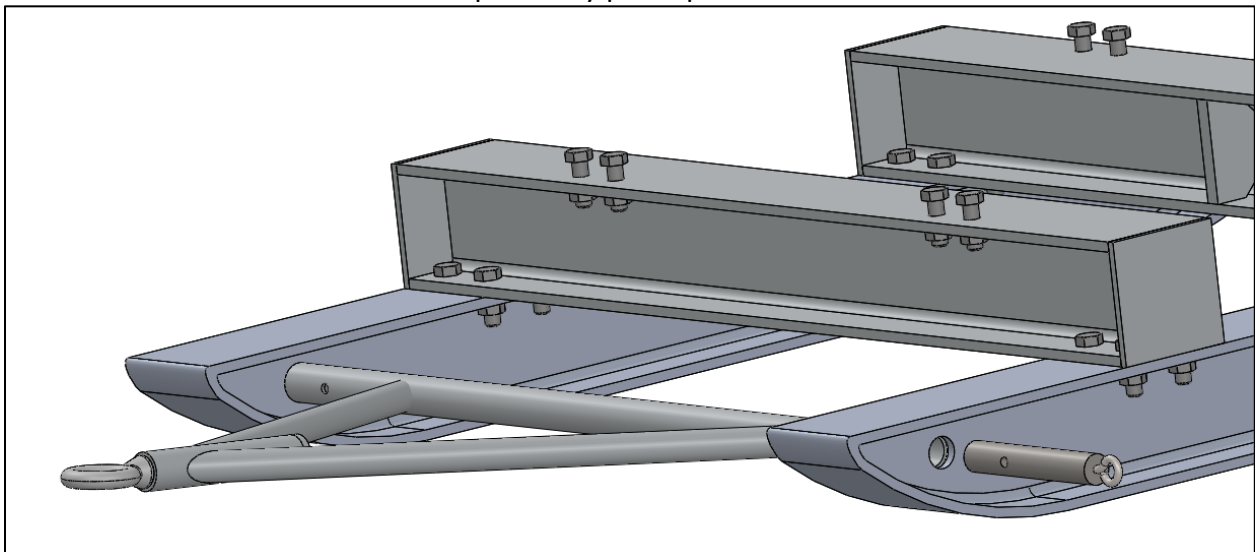


Figure 1: Tow bar attachment

### 7.2.2 Standard assembly:

- Choose a location that is in line with the logging tower / tripod and an appropriate distance away. The cable should deviate no more than 20deg left or right of the centerline of the winch. Additionally, the cable should not dip more than 15deg below horizontal or exceed vertical.
- Level the surface where the winch is going to be placed.
- Place the included plywood sheet onto the leveled area.
- Slide the winch sled fully onto the plywood platform. This will minimize the amount that the winch melts into the surface.
- Run two separate rope loops off the back of the winch sled and anchor to two separate points in the surface, Figure 2. (Dead-men in firn or V-threads in ice.) This is to prevent the winch from being pulled towards the borehole.

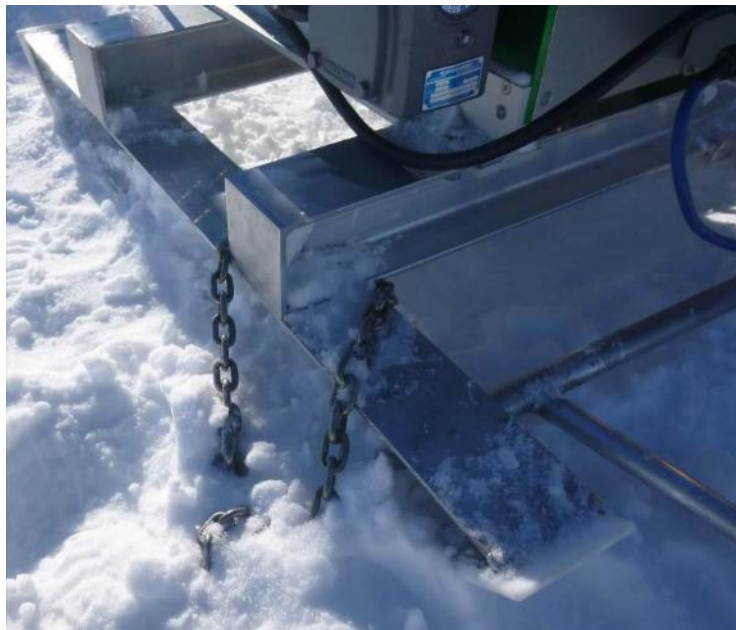


Figure 2: Anchoring the sled

- Slide the drip tray on top of the plywood underneath the winch cable drum and pulleys.
- Payout cable to feed through the logging tower / tripod.
- Setup a cable vacuum or brush if the cable is expected to come back very wet or slushy. This can be as simple as a few absorbent pads tied around the cable and fixed to a bamboo stake in front of the winch, Figure 3.
- Setup the control box nearby the winch.
- Connect all electrical cables as labeled.





Figure 3: Simple cable wipe setup

### 7.3 Attaching Logging Tools

- 7.3.1 Logging tools are connected to the winch through the Gearhart-Owen 1"-OD 4-conductor cablehead on the end of the winch cable.
- 7.3.2 Secure this connection by tightening with two wrenches.
  - Do not use the strain relief wrench to hold the cablehead.
- 7.3.3 Using the weight stack:
  - If a logging tool weighs less than 20 lbs or is nearly buoyant because of internally sealed gas (including air), the weight stack must be installed above the logging tool.
  - Use the strain relief wrench to remove the strain relief coil from the Gearhart Owen connector on the winch cable and slide it a few meters up the cable.
  - Align the U-channels along the length of the weight stack.
  - Lay the winch cable through the weight stack with the weight stack in between the cablehead and strain relief coil, Figure 4.
  - Tighten both the upper and lower brackets of the weight stack.
  - Screw the entire weight stack onto the cablehead where the strain relief coil was previously attached.
  - Attach the strain relief to the top of the weight stack.

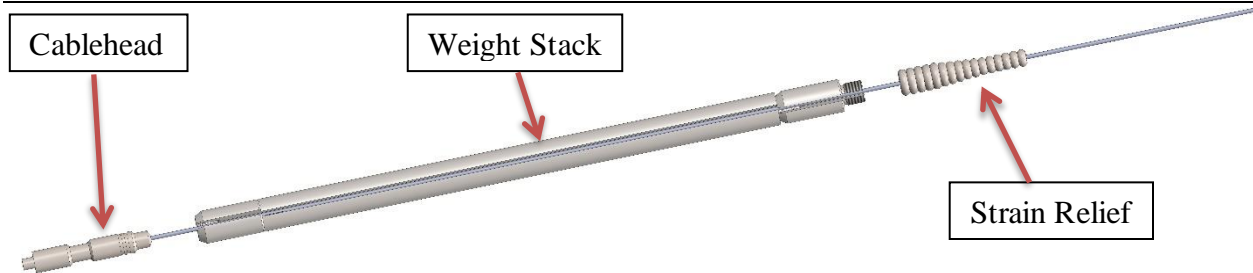


Figure 4: Weight stack assembly

## 7.4 Controls

### 7.4.1 Powering On:

- Before powering on the system, the following should be verified, Figures 5 and 6:
  - On/Off switch on control box depressed to Off position.
  - Up/Down switch on control box to Off position.
  - Local/Remote switch on control box to Off position.
  - Speed knob on control box to Min position.
  - Gear shift lever engaged to either position on winch.
  - Brake lever engaged on winch.
  - Up/Down switch on pendant to Off position.
  - Speed knob on pendant to Min position.
- Power on by twisting the On/Off switch on the control box clockwise to release the E-stop.



Figure 5: Control box faceplates





Figure 6: Winch layout

#### 7.4.2 Local / Remote:

- Local mode controls the winch through the controls on the control box.
- Remote mode controls the winch through the controls on the yellow pendant.

#### 7.4.3 Resetting depth reading:

- Move the logging tool to its zero reference position.
- Press 1 on the depth display.
- Adjust display to desired reading. Pressing 1 increments the rightmost digit, 2 the second rightmost digit, etc.
- Press E on the depth display to store this number in memory.
- Press R on the depth display to reset the display to this stored value.

#### 7.4.4 Gear speed selection:

- Most operations will occur exclusively in the high speed gear range.
- When in low speed gear, the max speed is 30 ft/min, max continuous load is 600 lbs, and max instantaneous load is 800 lbs.
- When in high speed gear, the max speed is 90 ft/min, max continuous load is 250 lbs, and max instantaneous load is 300 lbs.
- When standing behind the winch (looking towards borehole) there are three positions for the gear speed selection lever. Left is high speed. Center is neutral. Right is low speed.

#### 7.4.5 Changing gears on the surface:

- Stop the winch.
- Shift the speed selection lever to the center, neutral position.
- Spin the drum until the winch can be shifted into the other gear.

**7.4.6** Changing gears under load:

- Stop the winch and apply the brake.
- Wrap a cable grip onto the downhole side of the cable with the loop facing upwards.
- Use carabiners and/or rope to secure the cable grip to either the tower, tripod, or another surface structure.
- Release the brake and slowly payout the winch until the downhole load is fully held by the cable grip.
- Change gears as described in 7.4.5.
- Slowly pay-in the winch until the load is off the cable grip and back on the winch drum.
- Apply the brake and remove the cable grip, carabiners, and rope.
- Unwrap the cable grip from the cable.

**7.4.7** Alarms and alarm cutoff:

- The control box features an alarm system based on the tension being either too high (stuck tool) or too low (floating tool).
- See Appendix B for changing these values.
- On the back of the control box, there is a switch that controls the behavior of this alarm. The switch can be set such that the alarm disables power to the winch when it is triggered or is simply a visible alarm on the tension display.

**7.5** Operations

**7.5.1** The winch and cable should be monitored at all times during operation. The winch should never be left unattended while powered on or in motion.

**7.5.2** Power on as described in 7.4.1 and select Local or Remote mode (7.4.2).

**7.5.3** Release the manual brake lever.

**7.5.4** Utilize the speed and direction controls on the chosen control system to operate the winch.

**7.5.5** Adjusting the level-wind:

- The winch has a level-wind system that is designed to properly wind the cable onto the drum.
- The system is mostly hands off, but does need occasional adjustment to maintain proper tracking.
  - Prior field experience has shown that this adjustment is about half of the cable width every cable layer.
- To adjust the system, turn the level-wind adjustment knob, Figure 7, while pushing in the level-wind clutch button, Figure 8.
- The system should be adjusted such that while paying in cable, the cable is pulled tight to its previous wrap.



Figure 7: Level-wind adjustment knob



Figure 8: Level-wind clutch button

## 7.6 Storage

- 7.6.1 For overnight storage, the system can be left outdoors with a tarp strapped around the winch, the control box unplugged and closed up, and all loose wires capped.
- 7.6.2 At the end of the season, the system should be dragged back into its crate, level-wind end first. Creating a lead-in ramp with a pallet will greatly assist this process if forks are not readily available, Figure 10.



Figure 9: Storing the winch overnight



Figure 10: Packing the system

**8.0 APPENDIX A: PROGRAMMING THE DEPTH/SPEED DISPLAY**

To enter codes, press the corresponding code number, enter the desired mode value with the keypad, then press E. If the mode value is correct, as listed in the table below, without changing the value press E to exit to the main display.

CODE	MODE	DESCRIPTION
41	1	Counter/Rate
42	3	Reset Counter & Rate
43	5	Quadrature Counting
44	1	Single edge counting
45	2	Depth Scale Multiplier.001
46	3	Depth Decimal Point 0.00
51	2	Depth Counter B priority
52	3	Terminate at reset
53	.01	Timed output
56	2	Reset to Preset
61	1	Dummy Zero
62	1	Rate per Second
63	1	Rate Update
64	5	Rate Scale
65	2	Rate Decimal Point 0.0
66	2	Preset & Rest Enabled

To program Rate and Depth Scale Factor, press the +/- button to select counter A or B as desired, then press the **SF** or **"3"** button for the value display. Use the corresponding digit key to change the value. This must be done for both A and B counters.

Counter A (Rate) Scale Factors:

- Feet/minute – 0.2189 with code 62 = 2 and code 64 = 6
- Feet/second – 0.2189 with code 62 = 1 and code 64 = 6
- Meter/minute – 4.0032 with code 62 = 1 and code 64 = 6
- Centimeter/minute – 0.6672 with code 62 = 2 and code 64 = 5
- Meter/second – 0.0667 with code 62 = 1 and code 64 = 6
- Centimeter/second – 0.6672 with code 62 = 1 and code 64 = 5

Counter B (Depth) Scale Factors:

- Feet – 0.2189 with code 45 = 1
- Meters – 0.6672 with code 45 = 2

**Note: See the Gemini 4000 Instruction Manual for detailed explanations of all settings.**

**9.0 APPENDIX B: PROGRAMMING THE TENSION DISPLAY**

To enter Program Mode press P. Then press the up arrow key until the display reads 2.

Then press P. (P will need to be pressed each time you want to increment to the next step.)

CODE	ENTER	DESCRIPTION
decpt	0.0	Decimal Point
round	.5	Rounds reading by
scale	press ^ to get YES	Allow scale settings
Press P		
DSP 1	0.0	Display for input 1
INP 1	97	Input for DSP 1
DSP 2	484 for lbs; 220 for kg	Display for input 2
INP 2	2200	Input for DSP 2
sege	1	Linear scaling (none)

Press P and return to Main Menu. Press P again to exit Program Mode or continue.

If you need to change alarm trip points. Press up arrow key until display reads 6.

Press P again.

Trac	no	Alarm tracking
Disp	yes	Display during alarm
Latc 1	no	Unlatched alarm
Asn 1	Input	Acts on input
AL 1	<b>10 for lbs; 4.55 for Kg</b>	Alarm act @ 4.5Kg or 10 lbs
Hys. 1	.1	Hysteresis
Act 1	Lo	Alarm 1 Lo side
Latc 2	no	Unlatched alarm
Asn 2	Input	Acts on input
AL 2	<b>484 for lbs; 220 for Kg</b>	Alarm act @ 220Kg or 484 lbs
Hys. 2	.1	Hysteresis
Act 2	Hi	Alarm 2 Hi side

Press P to get to Main Menu.

Press P again to record info and exit Programming Mode.

**Note: See the Model IMS Instruction Manual for detailed explanations of all settings.**

**10.0 APPENDIX C: PREVENTIVE MAINTENANCE**

<b>IDLW Preventive Maintenance Checklist</b>			
<b>SEASONAL CHECKS</b>			
<b>(to be performed once per season or before shipment to field)</b>			
<b>ITEM</b>	<b>ACTION</b>	<b>DATE</b>	<b>INITIALS</b>
<b>SYSTEM</b>			
Packing list	Verify that complete system is packed		
<b>CABLE</b>			
Cable/cable termination	Inspect for damage		
Cable	Verify that cable is properly wrapped and tensioned		
<b>CONTROL SYSTEM</b>			
Control box wiring	Check for loose connections		
System	Verify all operations		
<b>ELECTRICAL</b>			
Power and signal cords	Inspect for damage		
Amphenol connectors	Verify the Amphenol connector backshells are tight on all cables		
Cable conductivity	Check for correct cable conductivity		
<b>SAFETY EQUIPMENT</b>			
Ropes	Inspect for damage/wear		
<b>WINCH</b>			
Winch system	Inspect for damage		
Calibration	Verify depth and tension calibrations		
Winch motor	Inspect for functionality/brake operation		
<b>COMMENTS:</b>			



<b>IDLW Preventive Maintenance Checklist</b>			
<b>WEEKLY CHECKS</b>		<b>WEEK OF: _____</b>	
<b>ITEM</b>	<b>ACTION</b>	<b>DATE</b>	<b>INITIALS</b>
<b>POWER DISTRIBUTION</b>			
Generators	Inspect for damage / check oil		
Cables	Inspect for cable damage		
<b>TOOLS</b>			
Tools	Inspect for damaged/missing tools		
<b>WINCH SYSTEM</b>			
Logging cable	Inspect for damage		
Bolts	Check all bolts for tightness		
Level wind	Grease level wind bearing with Aeroshell 22		
Brake	Inspect brake operation		
Pulleys	Clean material buildup from pulleys and wheels		
Levelness	Relevel the sled if necessary		
<b>COMMENTS:</b>			

**11.0 APPENDIX D: THEORETICAL CABLE WEIGHT**

Winch: IDLW

Fluid: Estisol 140

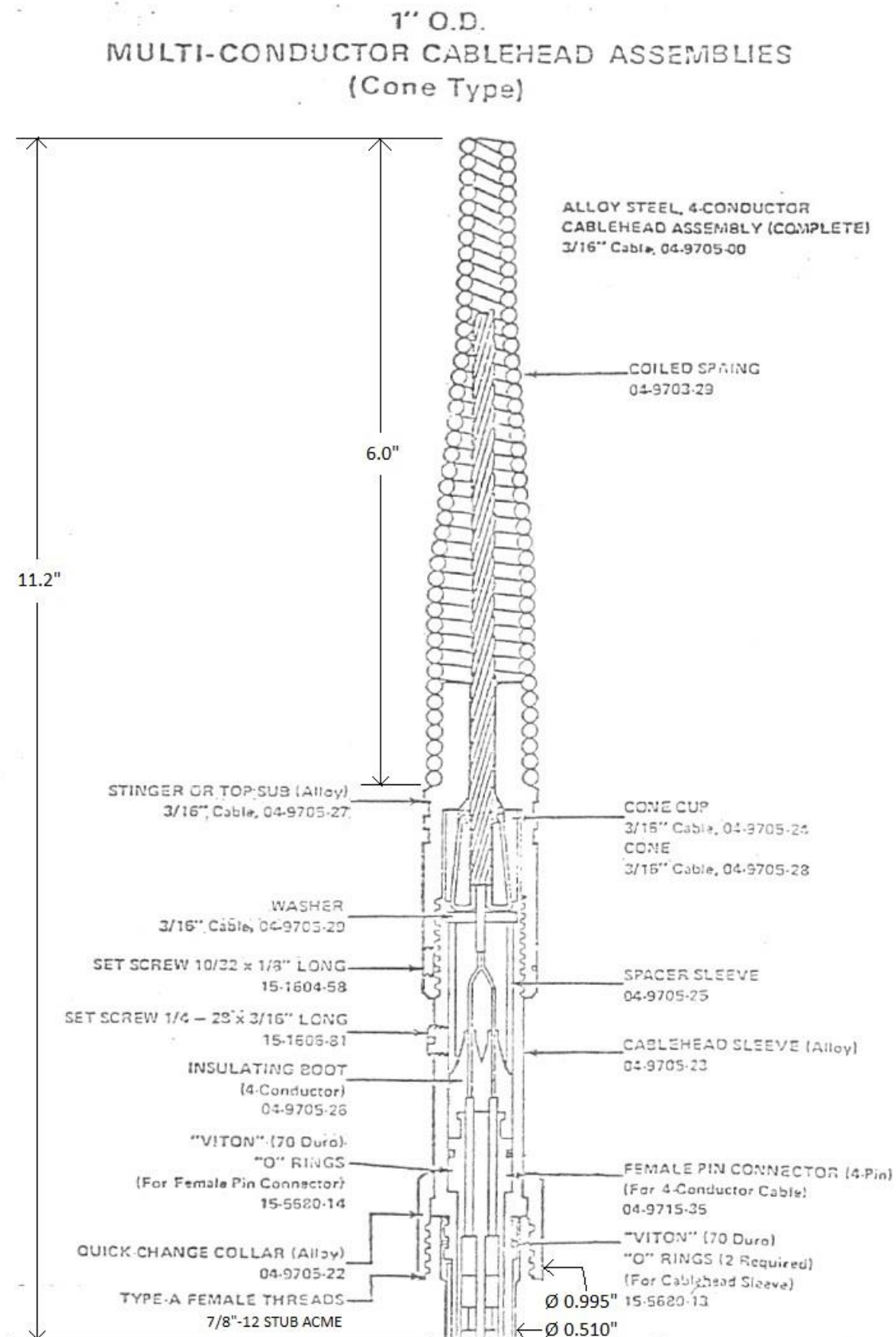
Fluid Depth (m): 118

Temperature (C): -50

Depth (m)	Cable Weight (lb)	Depth (m)	Cable Weight (lb)
0	0.0	1000	169.2
25	4.9	1025	173.3
50	9.8	1050	177.5
75	14.7	1075	181.6
100	19.6	1100	185.7
125	24.3	1125	189.9
150	28.5	1150	194.0
175	32.6	1175	198.1
200	36.7	1200	202.3
225	40.9	1225	206.4
250	45.0	1250	210.6
275	49.1	1275	214.7
300	53.3	1300	218.8
325	57.4	1325	223.0
350	61.6	1350	227.1
375	65.7	1375	231.3
400	69.8	1400	235.4
425	74.0	1425	239.5
450	78.1	1450	243.7
475	82.3	1475	247.8
500	86.4	1500	252.0
525	90.5	1525	256.1
550	94.7	1550	260.2
575	98.8	1575	264.4
600	103.0	1600	268.5
625	107.1	1625	272.6
650	111.2	1650	276.8
675	115.4	1675	280.9
700	119.5	1700	285.1
725	123.6	1725	289.2
750	127.8	1750	293.3
775	131.9	1775	297.5
800	136.1	1800	301.6
825	140.2	1825	305.8
850	144.3	1850	309.9
875	148.5		
900	152.6		
925	156.8		
950	160.9		
975	165.0		

Note: A separate Excel file exists with input variables that can be modified to specific situations.

## 12.0 APPENDIX E: GEARHART-OWEN CABLEHEAD



### 13.0 APPENDIX F: USER SUMMARY SHEET

#### Overview

- Max depth: 1800 m
- Cable: 3/16" diameter Rochester 4-H-181D A240181

#### Power requirements

- Max continuous power draw: 2.5 kW
- Min generator size: 4 kW (at sea level)
- Electrical power connection: 120V NEMA 5-15

#### Wiring

- Downhole cablehead: Gearhart Owen, 1" OD, 4pin (Appendix E)
- Surface connection: Amphenol PT06A-14-18P
  - User needs: Amphenol PT02A-14-18S or PT01A-14-18S or other equivalent
  - Amphenol pinout:
    - A = A wire
    - B = B wire
    - C = C wire
    - D = D wire
    - E = Armor
    - G = Encoder A
    - J = Encoder B
    - L = Encoder ground
    - F, H, K, M-U = (open)

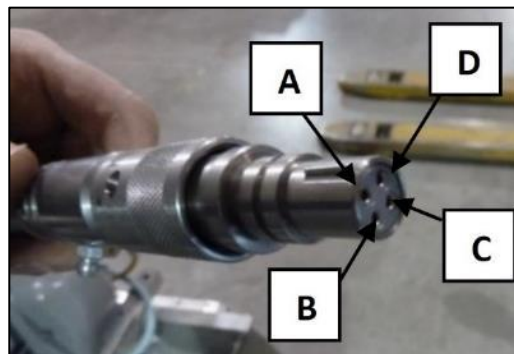


Figure F.1: Cablehead Pinout

#### Payout and Tension Interface

- Payout data: available as encoder pulses through surface tool connection
  - Payout calibration (meters): 500 pulse/rev, 0.0006672 meters/pulse, quadrature x1
- Tension data: available only via the display

#### Weights and Cubes

- Winch crate: 57" x 42" x 35", 900 lbs
- Control case: 39" x 24" x 12", 75 lbs
- Generator and fuel not included

**14.0 APPENDIX G: PACKING LIST**

Season:		Intermediate Depth Logging Winch		
User:		Where Used:		
Contents of the Winch Crate:				
	Item	Standard Qty	Qty Packed	Notes
1	Winch and sled unit	1 Each		
2	Plywood base	1 Each		
3	Drip tray	1 Each		
4	Tow bars	2 Each		
5	IDLW Operator's Manual	1 Each		
6	Paper documentation packet	1 Each		
7	Blue Amphenol-power cords	2 Each		
8	Control pendant	1 Each		
9	Orange wye cord	1 Each		
10	Black Amphenol connection cords	2 Each		
11	Three outlet extension cord	1 Each		
12	Cable grips	2 Each		
13	Crown sheave	1 Each		Optional: Tripod
14	Tripod central piece	1 Each		Optional: Tripod
15	Tripod extension	6 Each		Optional: Tripod
16	Tripod base piece	3 Each		Optional: Tripod
17	Rope	1 Each		Optional: Tripod
18	Plywood foot stand	3 Each		Optional: Tripod
19	Weight stack	1 Each		Optional: Logging Tool
20	Tool bag	1 Each		
Contents of the Tool Bag:				
21	Channel lock	1 Each		
22	Crescent wrench	2 Each		
23	English Allen wrench set	1 Each		
24	Metric Allen wrench set	1 Each		
25	Multi-bit screwdriver	1 Each		
26	Dead blow mallet	1 Each		
27	Needle nose pliers	1 Each		
28	Brass punch	2 Each		
29	Aeroshell 22 grease tube	1 Each		
30	Brush	1 Each		
31	Level	1 Each		
32	Tape measure	1 Each		
33	Calculator	1 Each		
34	Rope	1 Each		
35	Tow bar mounting bracket w/ safety pin	4 Each		
36	Winch fuse (20A)	3 Each		
37	Display fuse (2A)	3 Each		
38	Spare Amphenol PT02A-14-18S	1 Each		
39	Spare cablehead	1 Each		
40	Strain relief wrench	1 Each		
Contents of the Winch Case:				
41	Winch control system	1 Each		
Contents of the Logging Tower Case:				
42	Logging tower system	1 Each		Optional: Logging Tower (See separate packing list)