MX WINCH AND CONTROLLER

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Denver, CO. U. S. A.
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General Information

The MX winches are logging hoists capable of positioning a geophysical probe or other tools in a borehole. The MX winch line is comprised of the 4MXA-1000, 4MXB-1000 and 4MXC-1000. The system is equipped with slipring and connections through which surface instrumentation can communicate with the probe. A precision measuring wheel and rotary encoder are also included to allow the amount of cable played out to be tracked. The cable is automatically wrapped on the drum in even layers through the level wind mechanism. The motor is controlled by an 120V or 230V when properly configured, AC input, four-quadrant regenerative drive motor speed controller that allows the speed to remain constant with varying loads and prevents overhauling with heavy loads. The winch is designed to be used in conjunction with the MGX II or Matrix console and a portable PC to achieve a complete logging system.

AC supply Warning
Well regulated AC power is necessary. Surging or sagging output from the AC supply may damage electronics in the winch or console

Inverter Warning
When using a DC inverter to power the winch, a true sine-wave inverter is required for smooth winch operation. Minimum power requirement from such an inverter is 600 watts, which should also allow operation of the logger.

Figure 1
Winch Setup

To operate the winch in a borehole environment the following steps should be followed:

1. If the winch is in a carrying case, the case top should be un-latched and removed. Care should be taken not to snag any cables or other winch parts.
2. Release the MEASURE HEAD latch by pushing the LATCH PIN down.

Figure 2 Measuring Head Latch
3. Rotate the MEASURE HEAD from its stored position to the operation position.
4. Lift the PRESSURE WHEEL on the MEASURE HEAD and slip the cable between the PINCH WHEEL and the MEASURE WHEEL. Rotate the CABLE KEEPER knob until the keeper wheel is as close as possible to the FORWARD GUIDE WHEEL.

Figure 3

Figure 4 Proper cable path
4. Set the winch so the cable path will be within the limits of the measure head. These limits are:
   - 45° up
   - 5° down
   - 10° left, right

See figures 4 & 5

If the cable path must travel more than 5 degrees below horizontal the case should be tipped to provide the proper angle. Be sure to properly secure the case so it doesn’t slide.

Figure 5 Cable Path Limits

Figure 6 Normal Logging
5. Set UP / DOWN switch to Center position.
6. Set SPEED potentiometer fully counter clockwise (0).
7. Verify the POWER switch is in the out, off position.
8. Connect AC Power to the Winch controller.
9. Turn Winch AC Power On by pressing the silver button at center top.
10. Disengage manual brake by lifting the hand lever up.

11. Set Winch UP/Down Switch to Down
12. Apply tension* to the wireline then turn Speed Control Knob Clockwise and spool out enough cable to work with, perhaps enough to place the tool at the well.
13. Turn Speed Control Pot Fully Counter Clockwise to stop the winch.
14. Set the manual brake by pushing the hand lever down until it locks.
15. Set the UP/Down switch to Center position.
16. Remove protector caps from the cablehead and probe top and screw probe onto the cable head.

Power switch shown in the Off position.
Controller show configured for 120 Volt AC input.
Brake shown in the On position.

Not shown, at the top front of the motor controller is an AC output connector used with cable 500K-2274 to route AC power to the Matrix logger. 500K-2274 or another AC cable can be used to power the logger. The POWER switch does not control power connected with the front AC connector.

Figure 7 4MXA-3600 Controller and Brake

*MAKE SURE THE WINCH IS SECURE BEFORE APPLYING A LOAD TO THE CABLE LINE!!

16. Attach the probe to the cable head and check to see that the logger and power cables are connected to the Matrix logger as in FIGURE 1.
17. Turn on the Matrix logging system, and confirm probe operation.
18. Lower the probe into the hole.
19. Once the load of the probe has been applied to the winch make sure the MEASURE HEAD is at the proper angle.
   - The cable should not touch the CABLE KEEPER WHEEL but be fully in the groove of the FORWARD GUIDE WHEEL.
   - Be sure the Measure Wheel can turn freely and isn’t resting on the case.
Operation

Once the winch and logging system have been setup, the probe can be run or positioned in the borehole using the following procedures.

IMPORTANT: The MX winch has a manual brake carefully read the following:

STOPPING THE WINCH
1. To stop the drum and hold the cable in place:
2. Turn the speed knob to the full CCW, 0, position then apply the brake by pushing the lever down until it locks.
3. Put the UP/DOWN switch in the CENTER position.
   a. With UP/DOWN switch in CENTER position the controller will apply a Regen braking force to the motor. With a heavy load without the brake set the wireline may creep.

   IF POWER IS LOST, THE BRAKE HANDLE SHOULD BE PUSHED DOWN TO PREVENT PROBE RUNAWAY. THE UP/DOWN SWITCH SHOULD THEN BE PUT IN CENTER POSITION.

TO RUN DOWN
b. Rotate the SPEED knob fully counter-clockwise.
c. Move the UP - DOWN switch to DOWN. Note that this switch is a hesitation switch and will need to be put into a neutral (center) position during direction transition.
d. If the brake is on lift the brake lever up until it fully disengages.
e. Rotate the SPEED knob clockwise until the desired speed is achieved.

TO RUN UP
a. Rotate the SPEED knob fully counter-clockwise.
b. Move the UP - DOWN switch to UP. Note that this switch is a hesitation switch and will need to be put into a neutral (center) position during direction transition.
c. If the brake is on lift the brake lever up until it fully disengages.
d. Rotate the SPEED knob clockwise until the desired speed is achieved.

TO BRAKE POSITION
Turn the speed knob to its full CCW position, push the brake lever down until it latches, move the UP/ DOWN switch to its center position.

Note: Always rotate the speed knob fully counter-clockwise before moving to the center position to minimize abrupt direction changes to the system.

To re-pack the winch
1. Spool cable onto the winch leaving a small loop to allow cable head to be inserted in keeper tube.
2. Remove cable from underneath guide wheel and pinch wheel.
3. Rotate measuring head up and towards controller side and lock in position.
4. Set brake on.
Level Wind Adjustment

The motion of the level wind carriage has been carefully timed with the drum rotation. This timing should keep the cable wound evenly on the drum. If adjustments are needed push in the CLUTCH ADJ. BUTTON and turn the knurled LEVELWIND ADJ. KNOB on the opposite end of the Levelwind Ball Screw. See Figure 10

The CLUTCH ADJ. BUTTON, shown in the drawing on the left, is pushed in so that the hex-lock on the level wind shaft is free to be turned using the LEVELWIND ADJ. KNOB (shown in the drawing on the right). You must hold this button in while turning the knob.

Figure 8 Level Wind

When the level wind carriage is properly positioned, release the CLUTCH ADJ. BUTTON then turn the knob slightly to reengage the clutch. The ball screw is coupled to the drive sprockets through an index clutch. The rotation of the level wind ball screw is geared to the drum through the level wind drive train sprockets.

Figure 9
Emergency Cable Retrieval

IF POWER TO THE WINCH IS INTERRUPTED THE BRAKE LEVER SHOULD BE PUSHED DOWN UNTIL IT LOCKS. THIS WILL PREVENT THE WINCH FROM LETTING OUT CABLE.

In the event power to the winch is lost, the cable can still be retrieved. The motor gearing is a spur gear system that will allow the unit to be cranked manually. Locate the manual hand crank pictured below and proceed as follows:

a. Insert the manual crank handle into the coupler in the right side of the winch.
b. With a firm grip on the crank, place the Up/Down switch in UP, release the brake by pushing the lever up.
c. Turning the crank counter clockwise should spool the cable back onto the drum. The level wind system should work as normal.

Figure 10 Manual Crank
Troubleshooting

In the event the Winch Control develops a problem, follow the trouble shooting procedure listed below.

Problems with the winch mechanism

Problem: The cable is not wrapping smoothly.

Solution 1: The level wind screw needs to be adjusted to align the incoming cable with the correct path.

Solution 2: The cable has been run out past the bottom row and does not have the proper amount of wraps designated for the cable size.

Solution 3: Check that all screws on the level wind shaft are tight.

Problems with the winch controller

Problem: Control does not turn on or motor on winch will not function.

Solution 1: Is the power cord plugged in and the switch turned on (pressed in)?

Solution 2: Check AC power source.

Solution 3: Place the UP, DOWN switch in either position other than the center position and rotate the SPEED knob clockwise.

Solution 4: Remove AC Power plug and check the line fuse(s) located on the bottom of the controller panel. 230 VAC versions use both fuses, 120 VAC versions use only the top fuse, bottom fuse is a spare.

Solution 5: If there is no response from #5 then consult Mount Sopris.

The Control should never be disassembled unless service is necessary. In the event service is necessary, only Mount Sopris Instrument Company personnel, or a qualified technician should perform it.
Connections

120V AC
This is the 120 Volt AC input for the winch. When configured for 230 VAC a sticker labeled 230 VOLTS will be applied next to this connector.

AC OUT
This is the voltage output that can be used to supply AC power to the Matrix. It is turned on or off by the motor controller power switch.

WINCH/SIGNAL
This connector carries the cable lines and the encoder signals. The connector is compatible with the MGXII and Matrix series of console logging acquisition boxes with the appropriate interconnect cable.

Note: There is no longer a terminal strip at which the wireline and slip ring are connected. Use the 10-way connector pins for testing the wireline.

**MOTOR POWER**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Origin</th>
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<tbody>
<tr>
<td>Black Wire</td>
<td>D.C. voltage</td>
<td>Speed controller</td>
</tr>
<tr>
<td>Red Wire</td>
<td>D.C. voltage</td>
<td>Speed controller</td>
</tr>
<tr>
<td>Green Wire</td>
<td>Chassis ground</td>
<td>Side Plate Lug</td>
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**AC Power IN or OUT**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
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<tbody>
<tr>
<td>A</td>
<td>AC</td>
<td>AC WHT</td>
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<tr>
<td>B</td>
<td>AC</td>
<td>AC BLK</td>
</tr>
<tr>
<td>C</td>
<td>GND</td>
<td>GND LUG</td>
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**WINCH – 1 and 4 conductor**

<table>
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<th>Signal</th>
<th>Origin</th>
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<tbody>
<tr>
<td>A</td>
<td>ARMOR</td>
<td>Cable line</td>
</tr>
<tr>
<td>B</td>
<td>WL 1</td>
<td>Cable line</td>
</tr>
<tr>
<td>C</td>
<td>Encoder GND</td>
<td>Encoder</td>
</tr>
<tr>
<td>D</td>
<td>Encoder PWR (+5)</td>
<td>Encoder</td>
</tr>
<tr>
<td>E</td>
<td>Encoder B+</td>
<td>Encoder</td>
</tr>
<tr>
<td>F</td>
<td>WL 2</td>
<td>Cable line</td>
</tr>
<tr>
<td>G</td>
<td>Encoder A+</td>
<td>Encoder</td>
</tr>
<tr>
<td>H</td>
<td>WL 3</td>
<td>Cable line</td>
</tr>
<tr>
<td>J</td>
<td>WL 4</td>
<td>Cable line</td>
</tr>
<tr>
<td>K</td>
<td>No Contact</td>
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</tr>
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</table>

**FUSE**
TYPE: BUSS ABC 5A 250V or equivalent.
TOP Fuse is used for 120/240
BOTTOM Fuse is used when controller is configured for 240VAC but is spare for 120VAC configuration.
Maintenance

Wireline - Cablehead

The standard wireline is steel armored with an insulated center conductor. The wireline should be examined periodically for kinks, separated strands and other damage. At least monthly the cablehead should be disassembled and the cone and sleeve termination examined for mechanical integrity.

Warning: The wireline is steel and it will rust, this is particularly a problem around the cone and sleeve assembly where severe rust may lead to mechanical failure resulting in loss of a probe downhole. When operating the wireline in corrosive or saline environments clean and wipe the wireline before spooling it onto the winch. Rust can also damage the drum core and flanges.

It is a good idea to disassemble the cablehead and examine it every week or so or after prolonged storage.

The wireline should often be tested for electrical integrity with an ohmmeter, capable of measuring resistance of at least 20 million Ohms, perhaps before beginning each days logging and particularly if there is any problem with tool operation or communications.

Keep the cablehead threads and O-ring free of grit and dirt, lightly lubricate threads with white grease or similar and the O-ring with silicone grease. Keep the center of the brass cablehead nut clean and scrub off any tarnish.

Don't drop the cablehead as it is easy to bend and loosen the cablehead nut and mecca bulkhead connection. If this becomes loose water may seep under the bulkhead causing a short. Do not overtighten it or the fine threads in the nut may strip.

Consult SingleConductorReheadInstructions.pdf for detailed instructions on troubleshooting and re-heading of the wireline.

Lubrication

The BALL SCREW, the level wind carriage SUPPORT SHAFT as well as the drum and level wind drive chain should be lightly lubricated with white Lithium grease available in the ship kit. The bearing supporting the drum and the ball screw are sealed bearings and should not require lubrication.

Chain Maintenance

The DRUM drive chain should be kept free of excessive slack. When the top of the chain is taut the sag in the lower portion of the chain should not be allowed to drag the front cross member.

To tighten the drum drive loosen the four screws holding the motor on to the motor mount plate. This may require the winch to be removed from the case. Slide the motor forward and retighten the screws.

The chain should be kept clean and free of excessive grit and dirt.

Chains can be cleaned with any solvent that will cut through the accumulated grease and wash out the grit. Clean with a stiff bristle brush while applying solvent. The most common solvents used are kerosene or mineral spirits although both are flammable and need to be properly disposed. Protect the areas around the chain from over spray.

Alternately wipe the chain and areas between the links with cloth and brush then apply grease and wipe again. The grease left behind may be enough lubricant. Essentially anything adequate for a bicycle chain is suitable.

The level wind drive chain does not need to be as tight as the drum drive chain. These chains are under very little tension and 1/8" of chain slack is acceptable. As the system is used the chains will develop more slack and can be adjusted by loosening the screw through the center of the axle of the center sprockets. The eccentric axle allows tension for the front and rear chains to be adjusted independently.

To remove the winch from the case:

1. Extend the measuring head assembly into a normal, horizontal logging attitude.
2. Remove the Logger from the top of the winch and disconnect power and signal cables.
3. Turn the winch upside down by rotating it towards the side away from the measuring head being careful to not let it drop suddenly.
4. Do not allow the measuring head to take any of the weight of the winch.
5. Remove the mounting screws from the bottom of the plastic shipping case.
6. When reattaching the shipping case be sure to clean the bolts and apply blue locktite to their threads

**Re-Spooling Winch Cable**

If the winch is ever re-spooled completely or cable is removed from the bottom layer, the following measures must be observed.

**FOR 1/8 CABLE**

62.5 wraps should be put on the bottom layer. Subsequent layers should follow this pattern.

**4MXA-2700 Manual Brake Assembly**

The Manual Brake Assembly is adjusted at the factory to hold a stationary 100 lb weight. If the brake becomes loose it can be tightened with a 10 mm wrench by turning the nut on the drum side of the assembly clockwise.

The two friction pads are held in place by magnets attached on either side of the caliper assembly. If they wear beyond use the brake assembly must be removed to replace them.

To remove the brake caliper assembly the case and left side motor control must be removed and the left side winch plate must be loosened.

![Figure 11](image)

**Brake Assembly Removal**

- Start by removing the winch from its case, see page 13 “To remove the winch from the case:"
- Remove the motor controller by unscrewing the seven socket head cap screws around its periphery. See Figure 12, “Left Side Plate”.
- Inside the motor controller, disconnect the signal connector and if necessary the two wires to the DC motor so that it can be moved away from the winch plate.
MX Winch and Controller

- The left side plate must be loosened to allow enough space to pull out the brake assembly but before doing so you must support the left side drum flange with wood wedges placed under the front and rear edges.
- After the drum is supported release the brake handle then loosen the two brake mounting screws and nine side plate screws about ¼” or enough to allow the button head cap screw on the left side of the brake assembly to clear. You will need 4 and 5mm Allen wrenches.
- Remove the two brake mount screws and pull the brake assembly out the back.

![Figure 12 Left Side Plate](image)

**Friction Pad Replacement**

- To replace the Friction pads remove the right side nut with a 10mm wrench. The right side pad will come out with the nut. The left side pad can then be removed by gripping it with needle nose pliers and pulling it out into. Both Friction Pads are magnetically attached. Replacement Friction Pads are part number 33-600-005.
# MX Winch and Controller

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<thead>
<tr>
<th>Specifications*</th>
<th>4MXA-1000</th>
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<tbody>
<tr>
<td><strong>Motor</strong></td>
<td>1/4 hp, SCR type</td>
</tr>
<tr>
<td><strong>Controller</strong></td>
<td>4-quadrant, with current limit</td>
</tr>
<tr>
<td><strong>Speed</strong></td>
<td>0 to 85 ft/min</td>
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<tr>
<td><strong>Load</strong></td>
<td>100 lbs</td>
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<tr>
<td><strong>Cable Capacity</strong></td>
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<td><strong>Shipping Weight</strong></td>
<td>134 lbs (original)</td>
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<td></td>
<td>143 lbs (current case)</td>
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<td><strong>Winch Size</strong></td>
<td>16 wide x 20.5 long x 12 high</td>
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<td><strong>Case Size</strong></td>
<td>17 wide x 17 long x 18 original case</td>
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<td></td>
<td>25 wide x 19 long x 18.5 current case</td>
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<tr>
<td><strong>Cable off-axis tolerance</strong>:</td>
<td>10° left, 10° right, 12° down, 45° up</td>
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<td></td>
<td>See figures 3, 4</td>
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<table>
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<td><strong>Cable Capacity</strong></td>
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*Specifications subject to change without notice