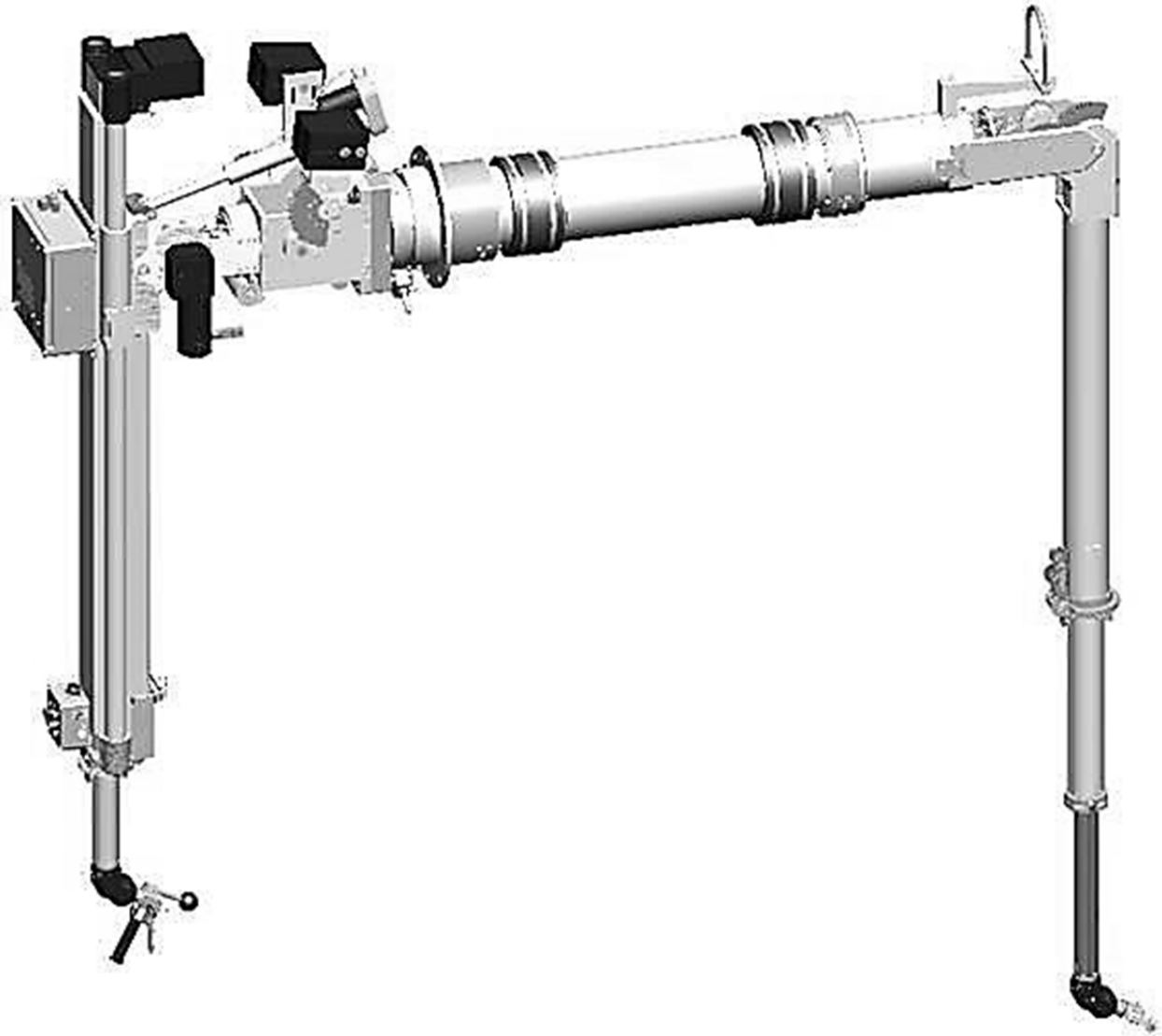


**MODEL N  
TELEMANIPULATOR  
OPERATION MANUAL  
(With Two-Speed Auto-Shift Handle)**



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July, 2013

CRLD-1046-B, Revision 1

**Notes**

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# Model N Telemanipulator Operation Manual

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## Section 1. Description

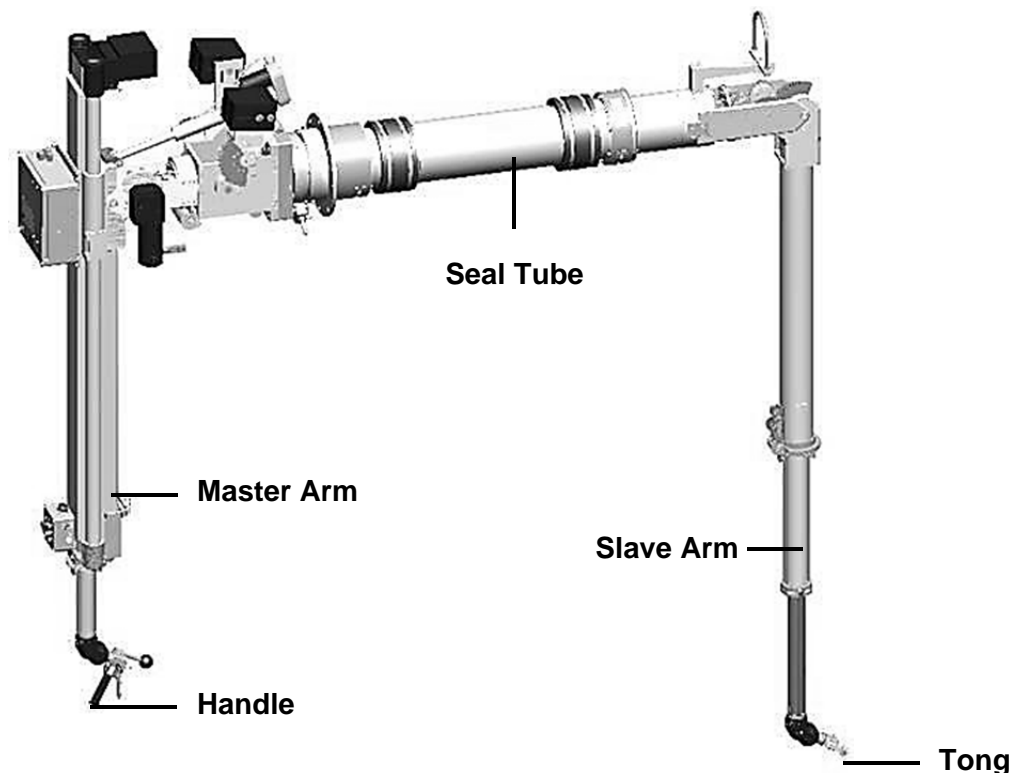
This manual provides operating instructions for the Model N Telemanipulator with the Two-Speed Auto-Shift Handle. A separate manual provides operating instructions for the manipulator with the Opposed-Grip Handle.

The Model N Telemanipulator (Figure 1-1) is designed to reproduce the natural movements and forces of the human hand. The Manipulator Tong will move exactly as the operator moves the Manipulator Handle, except for slight amounts of deflection and lost motion. The forces at the tong are equal to those applied at the handle, except for slight amounts of friction and unbalance. To increase the volume of coverage, electrical indexing is built into the Seal Tube and Slave Arm Assembly.

Telemanipulators allow operators, working in a 'Cold' area with the 'Master', to duplicate the Master movements with the 'Slave' located in adjacent 'Hot' areas.

A Telemanipulator consists of three main components: the Master Arm, which is located in the Cold area; the Seal Tube, which resides in the Wall or Barrier; and the Slave Arm, which is located in the Hot area.

The Master and Slave Arms are attached to a Seal Tube installed in the wall separating the areas. The operator's motions are translated from the Master Arm to the Slave Arm via the Seal Tube.



**Figure 1-1**

The Model N Telemanipulator is a sealed unit. The sealed system prevents the spread of radioactive contamination from the hot side to the cold side and also prevents leakage of impure gases into the cell area.

## Section 1. Description (Cont.)

The Manipulator consists of three distinct, easily separable assemblies:

- Master Arm (Figure 1-2)
- Seal Tube (Figure 1-3)
- Slave Arm (Figure 1-4)

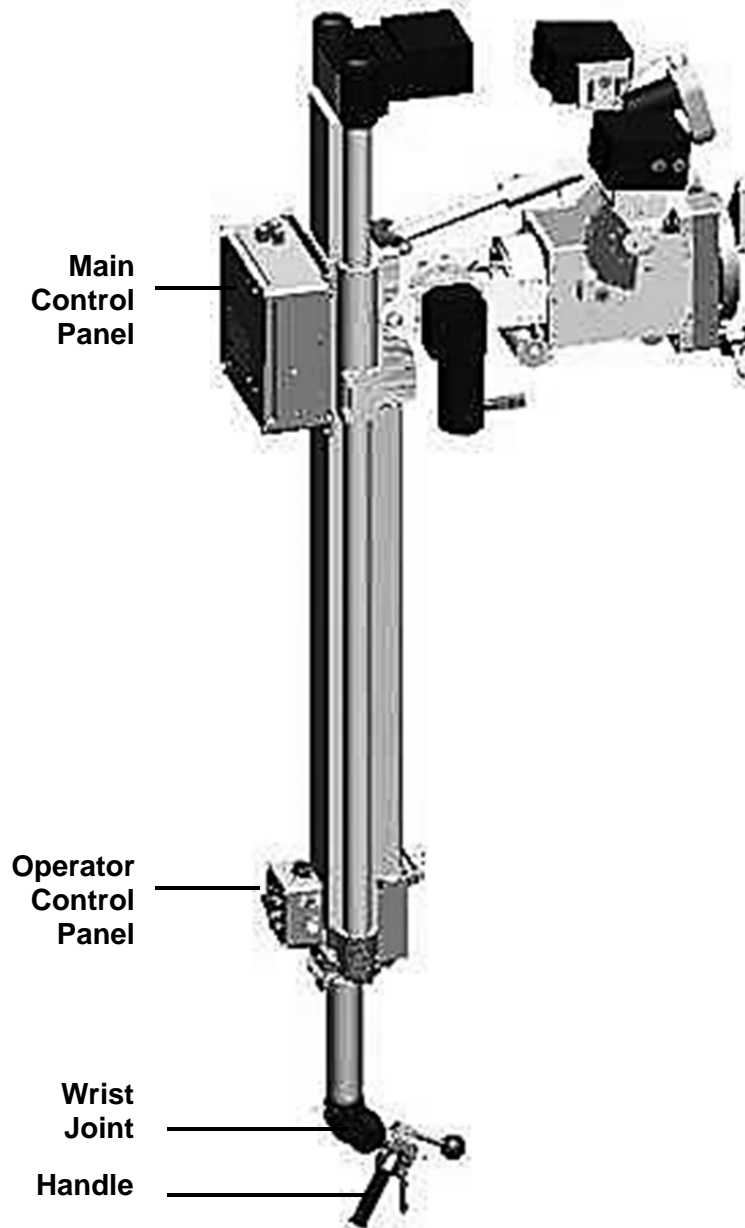


Figure 1-2. Master Arm

## Section 1. Description (Cont.)



Figure 1-3. Seal Tube

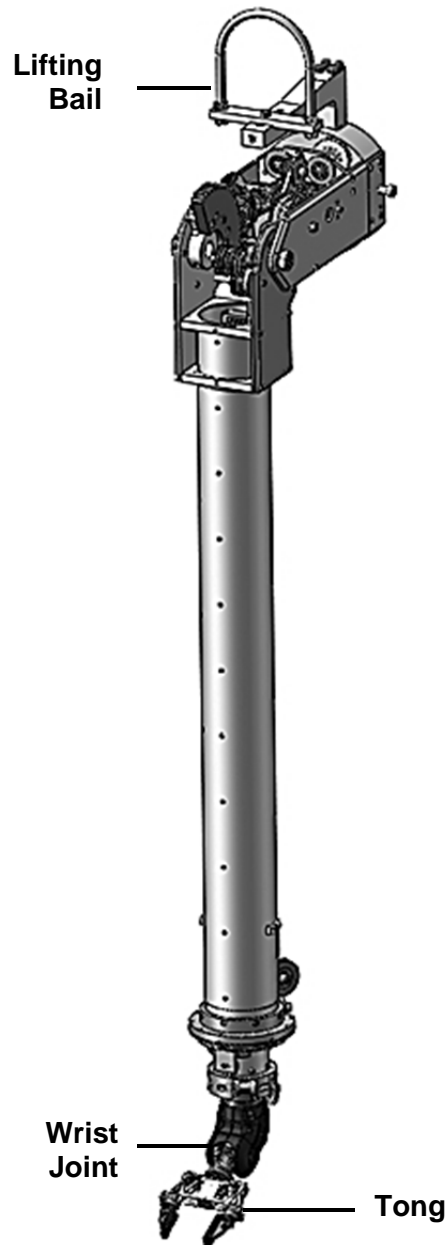
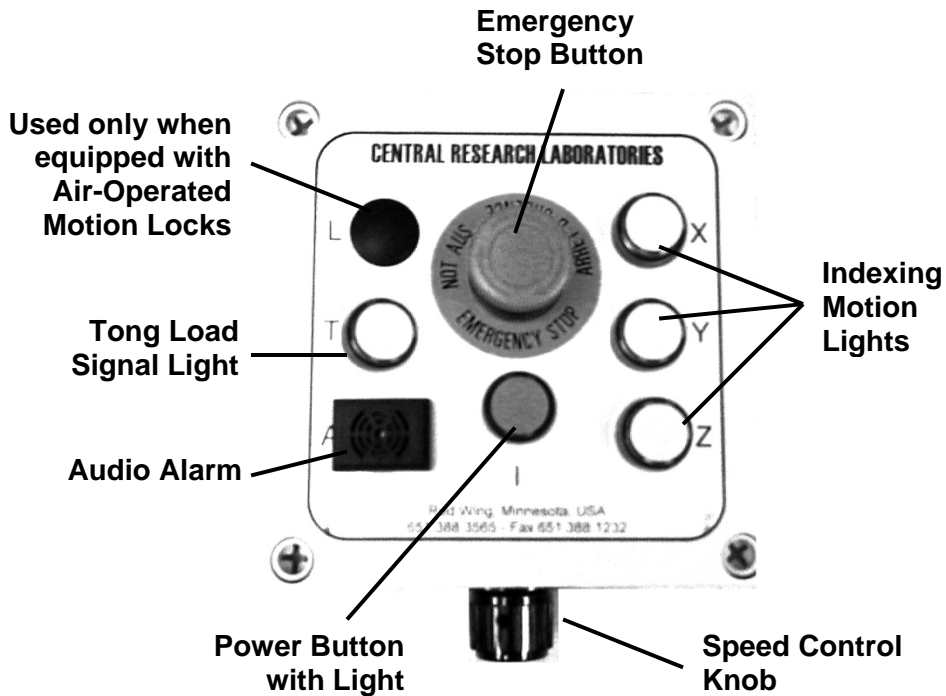


Figure 1-4. Slave Arm

# Model N Telemanipulator Operation Manual

## Section 1. Description (Cont.)

### 1.1 Operator Control Panel



| Control/Indicator       | Function   |
|-------------------------|--|
| Emergency Stop Button   | Removes power to the Manipulator. Rotate clockwise to reset if needed  |
| Indexing Motion Lights  | Lights to indicate the selected indexing motion  |
| Speed Control Knob      | Controls the speed of the indexing motion  |
| Power Button With Light | Lights when pressed to indicate power is applied for electrical indexing   |
| Audio Alarm             | Beeps when the Power Button is pressed to apply power, when switching between indexing motions, and when the Tong Load Signal is activated |
| Tong Load Signal Light  | Lights when the Tong Load Signal is activated  |

# Model N Telemanipulator Operation Manual

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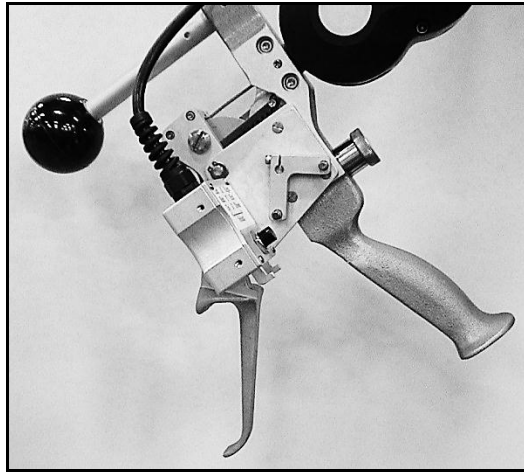
## Section 1. Description (Cont.)

### 1.2 Two-Speed Auto-Shift Handle

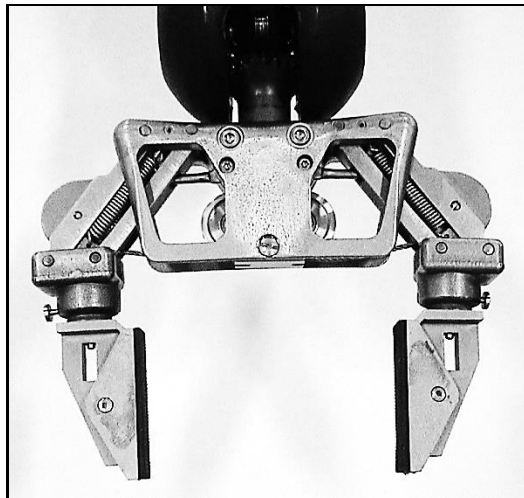
The Model N can be equipped with a Two-Speed, Auto-Shift Handle or an Opposed-Grip Handle. A separate Operation Manual provides instructions for operating the Model N with the Opposed-Grip Handle.

The Two-Speed, Auto-Shift Handle is designed for reliable heavy-duty control of the Tong. With this Handle, the Tong can be closed at two different speeds for the same handle squeezing motion. This feature is useful for delicate handling as well as for gripping and maintaining a hold on heavier objects.

The Tong is operated by grasping the Handle with either hand. Upon squeezing the Finger Handle, the Tong closes rapidly until a force in the Tongs is encountered whereupon the Handle automatically shifts to a higher, master-to-slave, squeeze ratio. The force at which the Handle automatically shifts can be adjusted with the Force Shift Adjustment Knob at the top-right of the Handle.



### 1.3 Tong. 18062



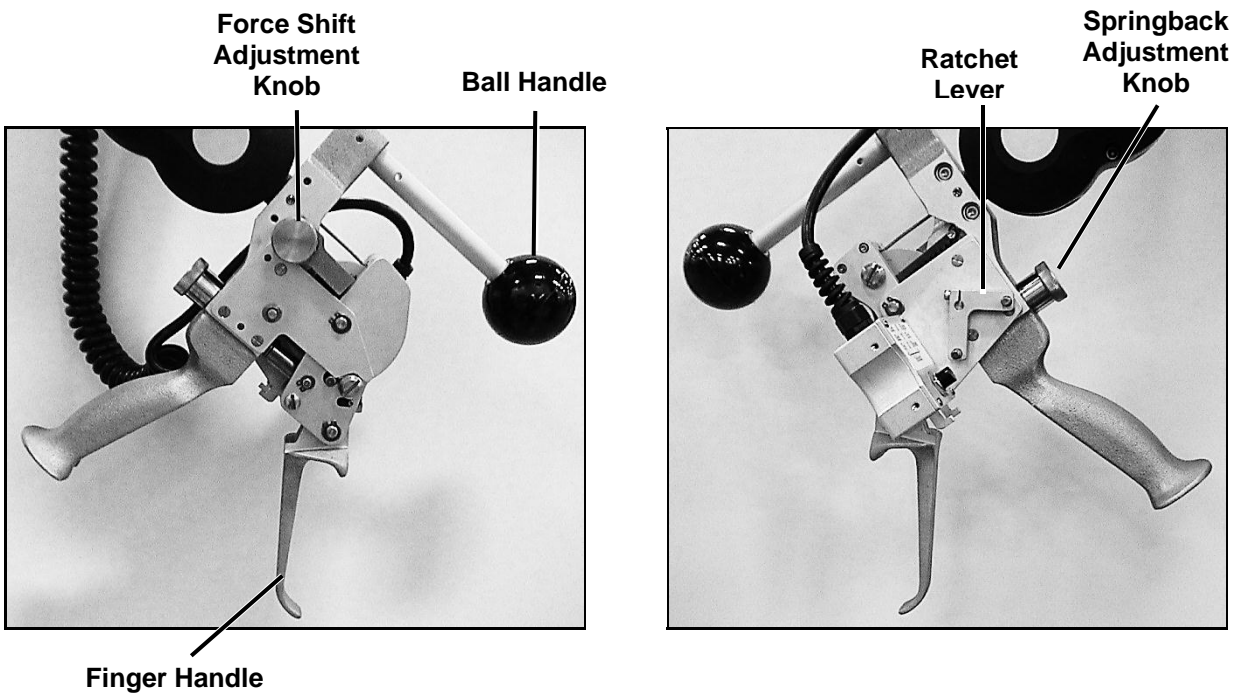


# Model N Telemanipulator Operation Manual

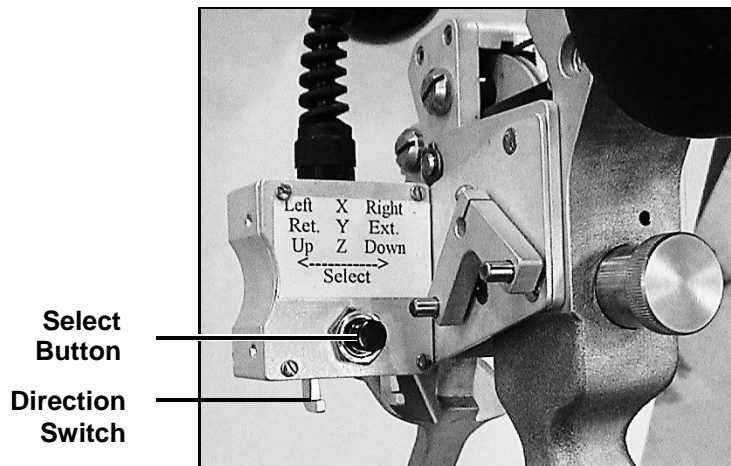
## Section 1. Description (Cont.)

### 1.2 Two-Speed Auto-Shift Handle (Cont.)

| Control/Indicator           | Function  |
|-----------------------------|---|
| Force Shift Adjustment Knob | Controls the force at which the Handle automatically shifts to a different grip                     |
| Ball Handle                 | Provides leverage for two-handed manipulator control  |
| Ratchet Lever               | Allows the Tong to hold in any fully- or partially-closed position                                  |
| Select Button               | Push to obtain the desired motion (X, Y, or Z)  |
| Direction Switch            | Determines indexing direction   |
| Finger Handle               | Squeezed by the operator to close the Tong  |
| Springback Adjustment Knob  | Controls the speed at which the Finger Handle springs back to an un-squeezed position when released |



Finger Handle



## Section 2. Operating Instructions

### 2.1 General

It is usually best to approach an object with the Tong in a position close to horizontal and, if possible, grasp the object above its center of gravity. Approaching the object with the Tongs in a vertical or 'straight down' position frequently results in an awkward and unnecessarily restricted maneuver. Once the object is grasped, lift and move in a natural manner as one would with his own hand. Watch the object being handled, not the Manipulator Handle. Soon the operator's hand and the Manipulator Tong will seem to operate as a unit.

An Auxiliary Ball Handle is provided to permit two-handed control of heavy loads. The position of this Auxiliary Handle corresponds to a point just above the center of gravity of the Slave Tong so the operator can support the major part of a heavy load with the Auxiliary Ball Handle cradled in the palm of one hand while the other hand, relieved of the load burden, can perform any desired angular manipulation with improved dexterity and stability.

### 2.2 Handle Operation

The Ratchet enables the operator to hold an object for an extended period of time. It is engaged by rotating the Ratchet Lever. This maintains the Tong squeeze force with no further effort.

To release the object, the Finger Handle is squeezed to enable the Ratchet Pawl to be disengaged; the Ratchet Lever is moved forward, and the Finger Handle is then relaxed. The high squeeze force is immediately released, and with an accompanying noise if the squeeze force was very high.

The Maximum Tong Load is set to a gripping force of approximately 100 pounds. The Threshold Tong Load is set to a gripping force of approximately 80 pounds. The Tong Load Indicator and Alarm, on the Operator's Control Panel, flash and beep when the threshold load is exceeded. The alarm and indicator stay on when the maximum load is exceeded.

## Section 2. Operating Instructions (Cont.)

### 2.2 Handle Operation (Cont.)

#### 2.2.1 Normal Operation

For normal operation, the Force Shift Adjustment Knob is rotated fully-clockwise. At this setting, the Tong closes in approximately a one-to-one relationship with the squeezing of the Handle. The Tong closes in this manner until it encounters a force (grips an object). At this point, the Handle automatically shifts to a different speed. The Tong now closes only slightly for a large squeezing motion of the Handle. This allows the operator to increase the gripping force on the object with less effort. The Ratchet Lever can be rotated backwards to hold the Tong in a closed position. The Handle can then be "pumped" to develop higher grip forces while maintaining the Tong's grip on the object.

**CAUTION:** It is very easy to build up high grip forces when the Handle is "pumped". The operator should use the Handle to exert only the amount of gripping force necessary to handle the object. Excessive "pumping" of the Handle can cause damage to the object or Manipulator.

To release an object when the Ratchet Lever has been engaged, the operator must squeeze the Handle enough to allow free forward rotation of the Ratchet Lever. The Handle can then be released. The Tong may tend to open quickly, so the object should be resting on the floor or platform when released. A noise may accompany the release of the Handle if the grip force was very high.

#### 2.2.2 Alternate Operation

Some Manipulators are outfitted with booting on the Slave Arm. This booting can be stiff enough at the Tong to cause the Handle to shift speeds before touching or gripping an object. In this case, the Handle can be operated with the Force Shift Adjustment Knob rotated fully-counterclockwise. At this setting, the Handle will shift speed immediately when the Handle is squeezed, and the Tong will only close slightly for a large squeezing motion. As the Handle is squeezed further, it will shift back to the one-to-one speed relationship, with the Tong closing at a faster rate. The Ratchet Lever can be engaged and the Handle "pumped" as in normal operation, as well as the release of the grip force, making sure the object is resting on the floor or platform.

## Section 2. Operating Instructions (Cont.)

### 2.2 Handle Operation (Cont.)

#### 2.2.3 Additional Notes on Handle Controls

The Force Shift Adjustment Knob will tend to rotate counterclockwise during operation of the Handle, except when it has been rotated fully-clockwise. This is due to vibrations caused by manipulator operation. To ensure consistent operation of the Handle, it is recommended that the Force Shift Adjustment Knob be in a fully-clockwise or fully-counterclockwise position, rather than at an intermediate setting.

The Springback Adjustment Knob can be set at any position, depending on the operator's preference. The further the knob is screwed into the Handle, the faster the Finger Handle will spring back to an un-squeezed position when released. This knob, however, should not be fully screwed in. At least two threads should be visible.

The position of the Finger Handle can be adjusted by a screw located on the front, just above the gripping part of the Handle. The Finger Handle should be adjusted to allow the Tong to close fully (not gripping an object) before the speed shifts in normal operation.

## Section 2. Operating Instructions (Cont.)

### 2.3 Manipulator Motions

| Description     | Motion   |
|-----------------|--|
| X               | Left or Right  |
| Y               | Forward and Backward   |
| Z               | Up and Down, or Telescoping  |
| Azimuth         | Boom Tube Rotation   |
| Elevation/Twist | Movements of the Handle Resulting in Raising, Lowering, or Twisting the Tong |
| Tong Squeeze    | Handle Movements Resulting in the Tong Grasping or Releasing                 |

### 2.4 Manipulator Indexing

To operate the 'X', 'Y', and 'Z' indexing motions use the following procedure:

1. Plug in the Power Cord from the Main Control Panel into an electrical outlet.
2. Rotate the Emergency Stop Button on the Operator Control Panel clockwise to reset if needed.
3. Press the Power Button on the Operator Control Panel. The Indicator Light will come on.
4. Push the 'Select' Button on the Handle to obtain the desired motion. The 'X', 'Y', or 'Z' Indicator Lights will come on as each motion is activated. Only one motion can be operated at a time.
5. Use the 'Direction' Switch on the Handle to obtain the desired direction:
  - When the 'X' motion is activated, the 'Direction' Switch determines either right or left direction
  - When the 'Y' motion is activated, the 'Direction' Switch determines either forward or back direction
  - When the 'Z' motion is activated, the 'Direction' Switch determines either up or down direction
6. If one or more motions do not operate, check the Motors and the Main Control Panel electrical connectors.

Limit Switches deactivate 'Z' motion in one direction when the Master Arm is fully collapsed or fully extended.

 **CAUTION**

**Do not operate 'Y' motion when the Slave Arm is fully extended and the Master Arm is fully collapsed, or when the Slave Arm is fully collapsed and the Master Arm is fully extended.**

## Section 2. Operating Instructions (Cont.)

### 2.5 Motion Locks

Complete Motion Locks come in three distinct units: X Motion, Y Motion, and Z Motion. The Z Motion Lock also locks the azimuth rotation and wrist motions. The Tong Lock is a part of the Handle Assembly. The entire Manipulator can be locked rigidly in any position within the dimensional limits of the Manipulator. Besides being able to hold an object in space, the Motion Locks are useful for installation and removal of the Manipulator.

All motions of the Manipulator can be locked in any position.

Both X and Y Locks are operated by push-pull controls located near the Master Azimuth. The Z, Azimuth, and Wrist Motion Lock is located above the Master Azimuth and is operated by a lever system.

## Section 3. Tong Jaw Removal and Replacement

The SRL Tong features a body that is rigidly attached to the Slave Wrist Joint. The Jaws are remotely-removable using a special fixture. A number of Jaws of different shapes are available for special purposes. An Extended Reach Tong, or Long Tong, is available for use with the Tong Body and also requires a special fixture.

Fasten the Jaw Removal Fixture to a weighted base, to the table, or to the wall in the Cell within reach of the Manipulator(s).

### SRL Tong Replacement Procedure:

1. To remove the Jaws, slip the rectangular holes in the Jaws over the projections of the Tong Jaws Parking Fixture. Then pull the Tong away from the fixture.
2. To reconnect the Jaws, align the Tong Sockets with the Jaws, snap the Jaws in place, and slip the Jaws off the fixture projections.

