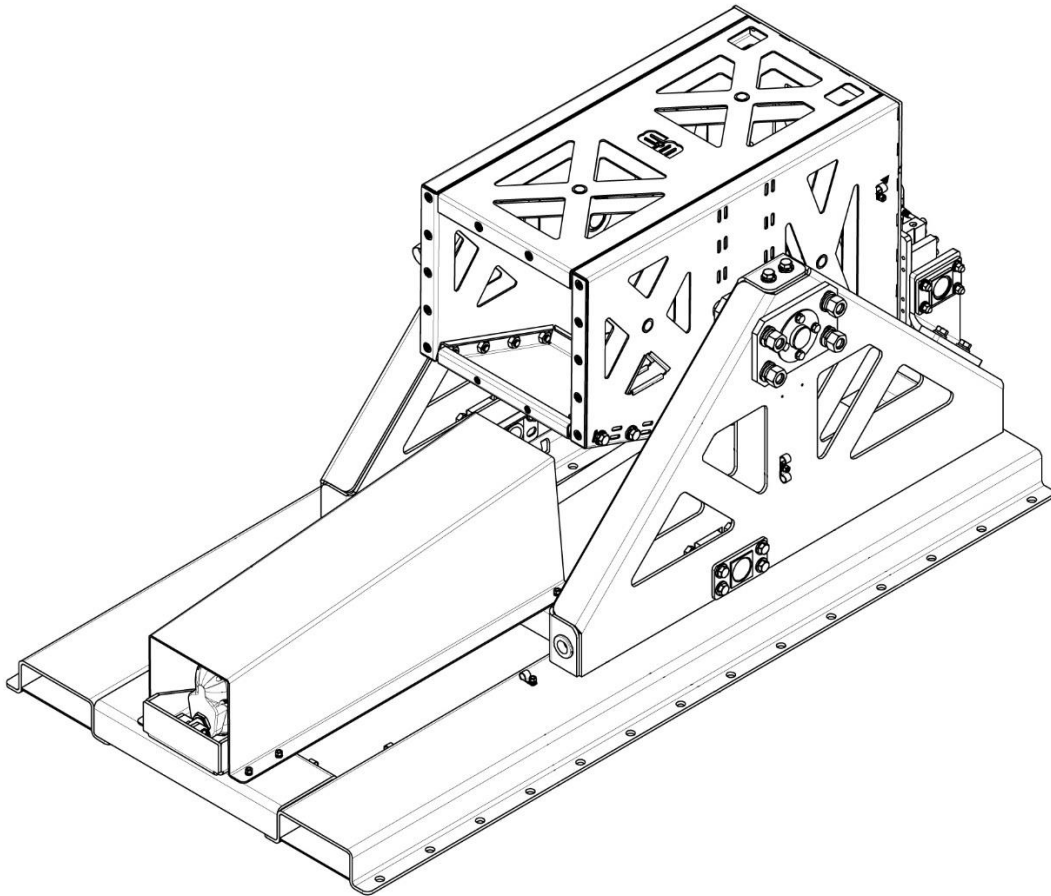




## AUTOMATED MAST TILTING SYSTEM (AMTS) 150 OPERATOR'S MANUAL



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TP-4584801-F, March 2019  
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Original Instructions



## Warranty

Will-Burt warrants its Automated Mast Tilting System to be free from defects in material and workmanship for a period of two (2) years, with such time period running from the date of shipment by Will-Burt. Will-Burt shall not be responsible for any damage resulting to or caused by its products by reason of failure to properly install, maintain or store the product; use of the product in a manner inconsistent with its design; unauthorized service, alteration of products, neglect, abuse, accident, or acts of God. This warranty does not extend to any component parts not manufactured by Will-Burt; provided, however, Will-Burt's warranty herein shall not limit any warranties by manufacturers of component parts which extend to the buyer.

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Claims for defects in material and workmanship shall be made in writing to Will-Burt within thirty (30) days of the discovery of defect. Failure to provide notice as required hereby shall be conclusive evidence that the product was in conformity with the warranty, and Will-Burt shall be released from any and all liability relating to the product. Will-Burt may either send a service representative or have the product returned to its factory at Buyer's expense for inspection. If judged by Will-Burt to be defective in material or workmanship, the product will be replaced or repaired at the option of Will-Burt, free from all charges except authorized transportation.

THE REMEDIES OF BUYER SET FORTH HEREIN ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER REMEDIES. THE LIABILITY OF WILL-BURT WHETHER IN CONTRACT, TORT, UNDER ANY WARRANTY, OR OTHERWISE, SHALL NOT EXTEND BEYOND ITS OBLIGATION TO REPAIR OR REPLACE, AT ITS OPTION, ANY PRODUCT OR PART FOUND BY WILL-BURT TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP. WILL-BURT SHALL NOT BE LIABLE FOR COST OF INSTALLATION AND/OR REMOVAL, OR BE RESPONSIBLE FOR DIRECT, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY NATURE.

## Document History

Document Numbers	Dates	Remarks
TP-4584801-A	September 7, 2010	Initial Release
TP-4584801-B	November 11, 2011	Revision 1
TP-4584801-C	December 31, 2013	Added warranty page.
TP-4584801-D	April 17, 2015	Updated Table 2-1 and Sections 1.2 and 1.3.1. Removed extra warranty page from Appendix A.
TP-4584801-E	June 2, 2016	Added Section 3.4.
TP-4584801-F	March 5, 2019	Updated manual to match current AMTS 150 configuration.

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## Safety Summary

This section describes safety precautions for the Automated Mast Tilting System. These are recommended precautions that personnel must understand and apply throughout many phases of installation, operation, transportation, maintenance, storage, and troubleshooting. Be sure the read and understand that entire manual, and contact The Will-Burt Company with any questions, before performing any procedure outlined in this manual.

## Signal Word Definitions

Per the ANSI Z535.4 standard, the following signal words and definitions are used to indicate hazardous situations:

### DANGER

DANGER indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.

### WARNING

WARNING indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

### CAUTION

CAUTION indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It is also used to alert against unsafe practices.

## General Safety Instructions

The following are general safety precautions that are not related to any specific procedures. These are recommended precautions that personnel must understand and apply throughout installation, operation, transportation, maintenance, storage, and troubleshooting. Additional precautions that apply to specific procedures and steps may be listed with the procedure or step to which they apply.

### DANGER

**Shock Hazard!** Observe general safety precautions for handling equipment using high voltage. Always disconnect power before performing repair or test operations.

### WARNING

**Resuscitation!** Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

### WARNING

Do not move the vehicle unless the pivot cradle / mast assembly is locked in the pivot down position.



**⚠ WARNING**

**Health and Safety Hazard!** Solvent used to clean parts is potentially dangerous. Follow solvent manufacturer's safety procedures and recommendations. Avoid inhalation of fumes and also prolonged contact to skin. Death or serious injury could occur if solvents are not handled properly.

**⚠ WARNING**

At all times prior to system operation you shall ensure that:

- The tilting system pivot path is free of personnel and mechanical obstruction.
- All electrical cables are undamaged and properly terminated.
- The control is receiving proper voltage and current.
- The mast assembly and payload are properly installed.
- Any transit tie-downs on the tilting system, mast assembly and payload have been removed.
- The vehicle is not moving.
- The area above the tilting system is free of mechanical obstructions. Striking an overhead obstruction can damage the payload and/or the tilting system.
- Ensure the area above the tilting system is free of electrical wires. Operator death may occur by pivoting the system and/or extending the mast into power lines.

**⚠ WARNING**

Use care when manually raising or lowering the Tilting System, because the normal stops and protections are being bypassed.

**⚠ WARNING**

Voltage may be present which can cause severe electrical shock. Always ensure that all electrical circuits to the Tilting System are de-energized and properly tagged during manual operation.

**⚠ WARNING**

Always turn off power before servicing the mast or the Tilting System.

**⚠ WARNING**

Make sure all personnel stay clear of the mast and Tilting System and the path through which they travel during powered and manual operation.

**⚠ WARNING**

Before performing maintenance or repair, make sure that the Stiletto mast and Tilting Systems are level and secure. Injury to personnel or damage to equipment could occur if the Stiletto mast and/or Tilting System tip over.

**⚠ WARNING**

Do not electrically energize the Stiletto Mast or Tilting System when manually operating the Tilting System. Always ensure that all electrical circuits to the Mast and Tilting System are de-energized and properly tagged to prevent injury during manual operations.

**⚠ CAUTION**

The actuators used to tilt the mast assembly and position the two lock pins are each supplied with a friction slip clutch to prevent serious damage to the actuator in the event of a jam. There is no way to detect the action of the slip clutch other than operator observation. If motion is obstructed, switch the POWER ON/OFF toggle switch to the OFF position immediately to avoid overheating the clutch.

**⚠ CAUTION**

Only trained and qualified personnel shall install, use and service the AMTS 150.

**⚠ CAUTION**

Deviation from standard operating conditions could cause Tilting System and/or mast failure.

## Section 1 Introduction

Review this manual in its entirety. Contact The Will-Burt Company with any questions before performing any procedure outlined in this manual. The views depicted in this manual are provided for clarification and are subject to change without notice. Views are not to scale.

This manual describes installation, operation, transportation, maintenance, storage, and troubleshooting procedures for the Automated Mast Tilt System (AMTS) 150. These procedures assume the use of a standard catalog AMTS 150. Procedures and characteristics for AMTS 150 customized to meet customer-specific needs may vary.

The AMTS 150 consists of a mechanical mast tilting assembly and a control system. The AMTS 150 can also be controlled through CANBUS.

### 1.1 Safety Precaution Notification

Refer to the Safety Summary for precautions to be observed while installing, operating, or maintaining this equipment.

### 1.2 Manual Organization

This manual is organized into the following sections:

Section 1 Introduction

Section 2 Installation

Section 3 Operation

Section 4 Transportation

Section 5 Maintenance

Section 6 Reference

### 1.3 Additional Documentation

In addition to this manual (TP-4584801), see your mast operator's manual for information pertaining to the mast. If necessary, contact The Will-Burt Company to obtain this document. Review and understand the mast operator's manual before performing installation, operation, transportation, maintenance, storage, and troubleshooting procedures for the mast.

## 1.4 Definitions of Terms

Throughout this manual, the following terms are used:

- “AMTS 150” to refer to the Automated Mast Tilt System 150
- “Mast” to refer to the telescoping mast that is installed inside the AMTS 150

See Section 6.1 for an Extended Glossary of Terms used within this manual. The Extended Glossary of Terms includes:

- General Terms and Abbreviations (Section □)
- Mounting Position Terms (Section 6.1.2)

## 1.5 Specifications

This section describes specification for the AMTS 150. The specifications listed in this section are for the catalog AMTS 150 only. For specifications on custom configurations or mast specifications, contact The Will-Burt Company.

*Table 1-1 AMTS 150 Specifications*

Functional Characteristic	Specification*
Approximate Weight (Including electrical system and cables)	735 lb.
Height with Pivot Cradle Vertical (90°)	40"
Height with Pivot Cradle Horizontal (0°)	32.5"
Overall Width	36.5"
Overall Length with Pivot Cradle Horizontal	69.5"
Estimated Tilting Time from Horizontal to Vertical (At actuator full load condition)	70 sec.
Estimated Tilting Time from Vertical to Horizontal (At actuator full load condition)	70 sec.
Operating Voltage Range	20 to 28 VDC
* Specifications for AMTS 150 only. Mast not included.	

## 1.6 Major Components

This section describes major components of an AMTS 150 assuming the use of standard catalog AMTS 150. Characteristics of components customized to meet customer-specific needs may vary. If necessary, contact The Will-Burt Company for additional details.

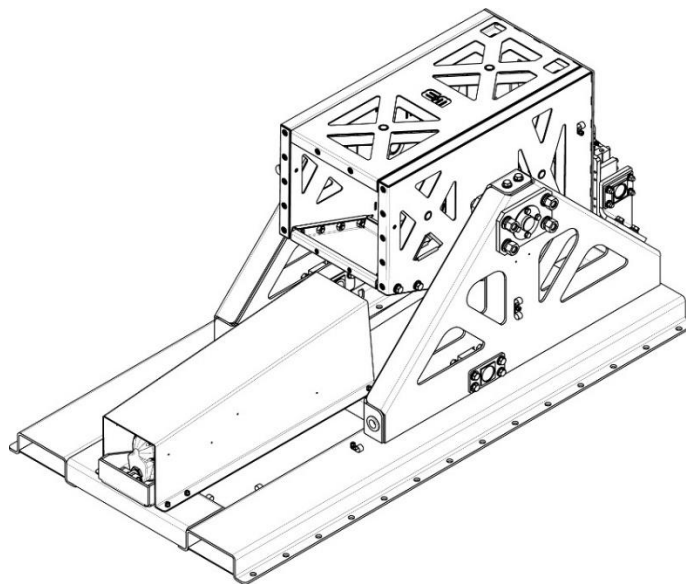
Major components of the AMTS 150 include:

- Automated Tilt Assembly
  - Tilt System Support Structure
  - Pivot Cradle
- Support Bracket
- Control Box
- Hand-Held Remote Control (HHRC)
- Long Crank Handle Assembly (P/N: 5339103)

### 1.6.1 Automated Tilt Assembly

The Automated Tilt Assembly (Figure 1-1):

- Is used to secure and support the mast.
- Pivot the mast between horizontal (0°) and vertical (90°).
- Is secured to the mounting surface.
- Is controlled through the Control Box.
- Can be operated using CANBUS.



*Figure 1-1 Automated Tilt System*

### 1.6.1.1 Tilt System Support Structure

The Tilt System Support Structure (Figure 1-2):

- Is a rigid base that supports the Pivot Cradle.
- Secures the Pivot Cradle to the mounting surface.
- Has formed channels designed to accept the forks of a lift truck for transportation during installation.
- Contains the Tilt Actuator.
- Contains the locking pin receivers for both the horizontal (0°) and vertical (90°) positions

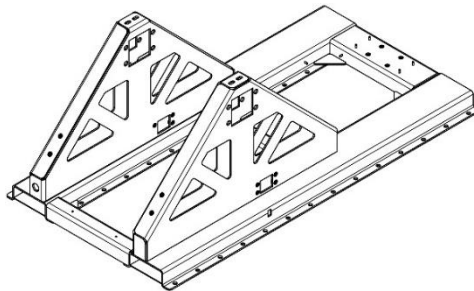


Figure 1-2 Tilt System Support Structure

The Tilt Actuator (P/N: 5289501) (Figure 1-3):

- Is a linear actuator used rotate the Pivot Cradle and mast between the horizontal position (when retracted) and the vertical position (when extended).
- Is pin-mounted on the motor end to the Tilt System Support Structure cross channel.
- Is pin-mounted on the piston rod end to the lower front of the pivot cradle.
- Uses internal limit switches to control position stops.
- Includes the actuator power and control cables which are hardwired to the actuator.

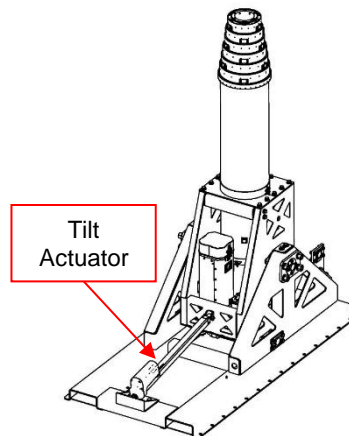


Figure 1-3 Tilt Actuator (Cover Removed for Clarity)

### 1.6.1.2 Pivot Cradle

The Pivot Cradle (Figure 1-4):

- Supports the mast.
- Is mounted on Pivot Pins in the Tilt System Support Structure.
- Is pivoted between horizontal (0°) and vertical (90°) by the Tilt Actuator.
- Contains the Lock Pin Actuator which moves the lock pins in and out.

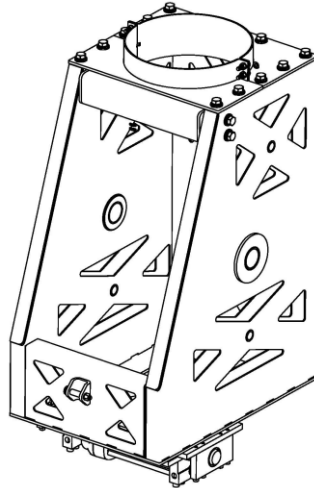


Figure 1-4 Pivot Cradle

The Lock Pin Actuator (P/N: 5289601) (Figure 1-5):

- Is a linear actuator used to lock and unlock the Pivot Cradle. When the Lock Pin Actuator is retracted, the tilt system lock pins are not engaged. When the Lock Pin Actuator is extended, the tilt system lock pins are engaged. In the event of a locking pin jamming, a slip clutch will engage to prevent damage to the Lock Pin Actuator.
- Uses internal limit switches to control position stops.
- Includes the actuator power and control cables which are hardwired to the actuator.

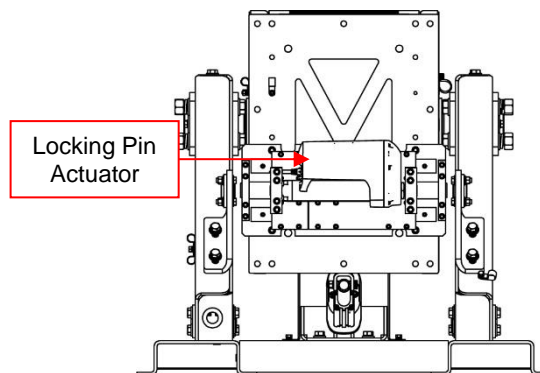


Figure 1-5 Lock Pin Actuator

## 1.6.2 Support Bracket

The Support Bracket (Figure 1-6 ) is used to secure and support the mast when in the transport position. When transporting the mast, the Support Bracket must be used.

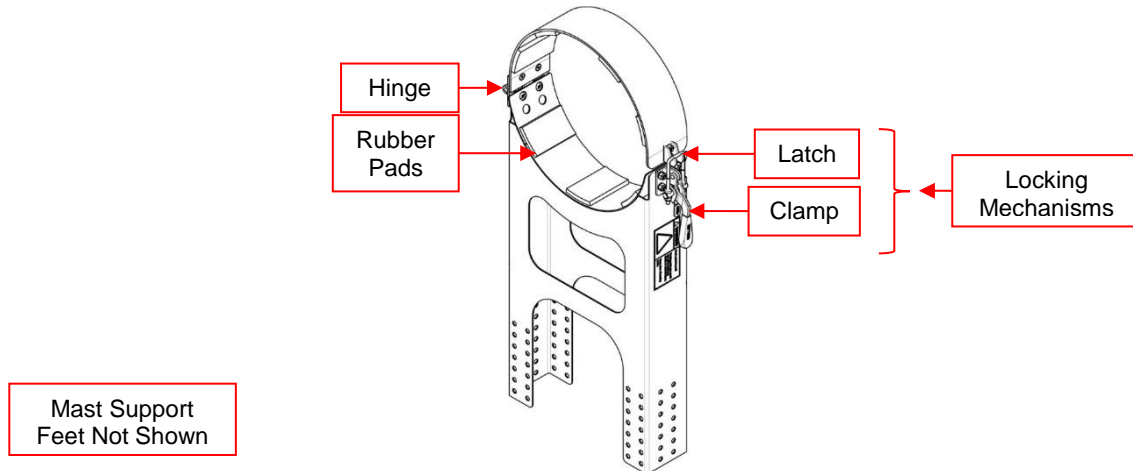


Figure 1-6 Support Bracket

## 1.6.3 Control Box

The Control Box (Figure 1-7):

- Includes a(n):
  - UP/DOWN Switch with waterproof boot that allows the operator to pivot the tilt system between horizontal (0°) and vertical (90°) and extend and retract the mast.
  - OVERRIDE Switch with waterproof boot that is used with the UP/DOWN Switch to ignore any errors returned by the Control Box in order to allow for emergency extension and retraction of the mast.
  - Display Screen that has an eight digit, infrared secure, green LED alphanumeric display to show the mast status, cycle count of the mast, and error codes.
  - Emergency Stop Button that stops all mast and tilt system motion when pressed.
- Bulkhead Connectors to allow for connection of the:
  - Lock Pin Actuator Power and Control Cables
  - Tilt Actuator Power and Control Cables
  - Mast Sensor and Mast Motor Cables
  - Customer Power In Cable
  - HHRC Cable
  - CANBUS Cables
- Has a Printed Circuit Board





Figure 1-7 Control Box

The Control Box displays:

- “STOWED” when the tilt is fully stowed (horizontal or 0° position)
- “TILTED” when the tilt is tilted
- “NESTED” when the mast is fully nested
- “DEPLOYED” when the mast is fully extended
- An intermediate extension height (in meters or feet) as interpreted from the Proximity Sensor in real-time as the mast extends

The intermediate extension height of the mast is shown:

- In metric mode as “XX.XX M” where:
  - XX.XX is the extension of the mast in meters
  - Resolution is 0.002 meters
  - Accuracy is ±0.05 meters
- In US customary mode as “XX.XX F” where:
  - XX.XX is the extension of the mast in feet
  - Resolution is 0.01 feet
  - Accuracy is ±0.17 feet

Note: Extension shown on the display of the Universal Control Box is measured from the top of the mast. Height readout does not include the nested height of the mast.

Remember:

$$\text{Total Height} = \text{Mast Extension Height (Shown on Display)} + \text{Mast System Nested Height} + \text{Mounted Height of Mast System}$$

Note: If using the PC Interface, it is possible to enter a Mast Offset Height to account for the nested height of the mast system and the height the Mast System is off the ground.

In order to output the most accurate intermediate extension height, the mast should:

1. Be returned to the fully nested position where the intermediate extension height automatically returns to zero.
2. Then be taken to the height required with little or no additional up and down movement as this additional movement adds inaccuracies within the intermediate extension height output.

### Cycle Counts and Temperature

When the mast is nested and the UP/DOWN switch held DOWN, the Display alternately shows the cycle count of the mast and the temperature inside the Universal Control Box. The cycle count is used during Periodic Maintenance of the mast.

### Error Codes

In the event of any unexpected switch feedback, communication errors, or amp draws on the mast, the Display will show the associated error message.

### 1.6.4 Hand-Held Remote Control (HHRC)

The optional Hand-Held Remote Control (HHRC) (Figure 1-8):

- Contains an SPDT (Mom-Off-Mom) toggle switch (UP/DOWN) protected by a switch guard and waterproof boot to extend and retract the mast
- Uses three LED lights to backlight text to indicate the status of the system as follows:
  - “EXTENDED” to indicate the mast is fully extended
  - “PARTIAL” to indicate the mast is partially extended
  - “NESTED” to indicate the mast is fully nested
- Includes a cable with a MS3106 8-pin screw-type connector that attaches to the front of the Universal Control Box at bulkhead J4. Multiple cable lengths are available.
- Is enclosed in a NEMA 4X box
- Does not have an alphanumeric display to show intermediate extension readouts



Figure 1-8 HHRC

### 1.6.5 Long Crank Handle Assembly (P/N: 5339103)

The Long Crank Handle Assembly (Figure 1-9) can be used to manually crank the mast motor to extend and retract the mast. When manually cranking the motor, it is necessary to remove all power from the system.



Figure 1-9 Long Crank Handle Assembly

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## Section 2 Installation

This section describes the installation of the AMTS 150 and provides general procedures that must be followed to ensure a successful installation. Use care to understand and follow all precautions while installing.

### 2.1 Pre-Installation Check

Before installing the system, ensure:

- All installers read and understand the entire installation procedure
- All components are included (Section 1.6)
- All required equipment is readily available (Section 2.2)
- The mounting structure is level with sufficient room to mount the system (Section 2.3)
- When installing in a vehicle, that the vehicle is stationary
- That the following precautions are understood and followed:

**⚠ WARNING**

**Trained Personnel Only!** Only trained and qualified personnel should perform installation procedures. Only a properly trained and qualified certified electrician should perform electric installations. Death or serious injury could result if proper installation procedures are not observed.

**⚠ WARNING**

**Mounting Structure Hazard!** Before installation, be certain the mounting structure is capable of resisting forces generated from all loading and environmental conditions including, but not limited to system size and weight, payload size and weight, sail area, wind speed, and ice loading. The mounting hardware must include proper means to resist vibration loosening such as thread-locking compound or locking hardware. Mounting the system to a structure unable to resist the forces generated from customer-specific loading scenario could result in death or serious injury and could damage the system.

**⚠ CAUTION**

**Equipment Damage – Cable Routing!** Cabling or Nycoil should be routed such that it cannot become trapped or pinched during equipment operation.

## 2.2 Installation Equipment

Table 2-1 lists equipment recommended for installation.

*Table 2-1 Equipment Recommended for Installation*

Recommended Equipment*		
Personal Protective		
Safety Glasses	Work Gloves	Nitrile or Vinyl Gloves
Hearing Protection	Hard Hat or Helmet	Safety Shoes
Hand Tools		
Mounting Hardware	Drill	Level
Measuring Tape	Rubber Mallet	Torque Wrench
Wrenches	Washers or Spacers (For Shimming)	
Equipment		
Hoist	Sling	
Expendables		
Anti-Seize	Thread-Locking Compound	Rags (Clean and Dry)
<p>* Note:</p> <ul style="list-style-type: none"> <li>Depending on the local, regional, and national standards and codes of practice, and the environment, additional personal protective equipment may be necessary.</li> <li>Depending on the system configuration, additional equipment, including but not limited to electrical components (e.g. wire, switches, fuses, circuit breakers, etc.), may be required.</li> <li>When disposing of any disposables or components, do so according to any applicable local, regional, and national standards and codes of practice.</li> </ul>		

## 2.3 Installation Dimensions

This section describes installation dimensions as follows:

- AMTS 150 Dimensions (Figure 2-1)
- AMTS 150 with 15 Meter Stiletto Dimensions (Figure 2-2)

Dimensions are provided for reference only and are not intended for vehicle design purposes. Characteristics of components customized to meet customer-specific needs may vary. If necessary, contact The Will-Burt Company for additional details.

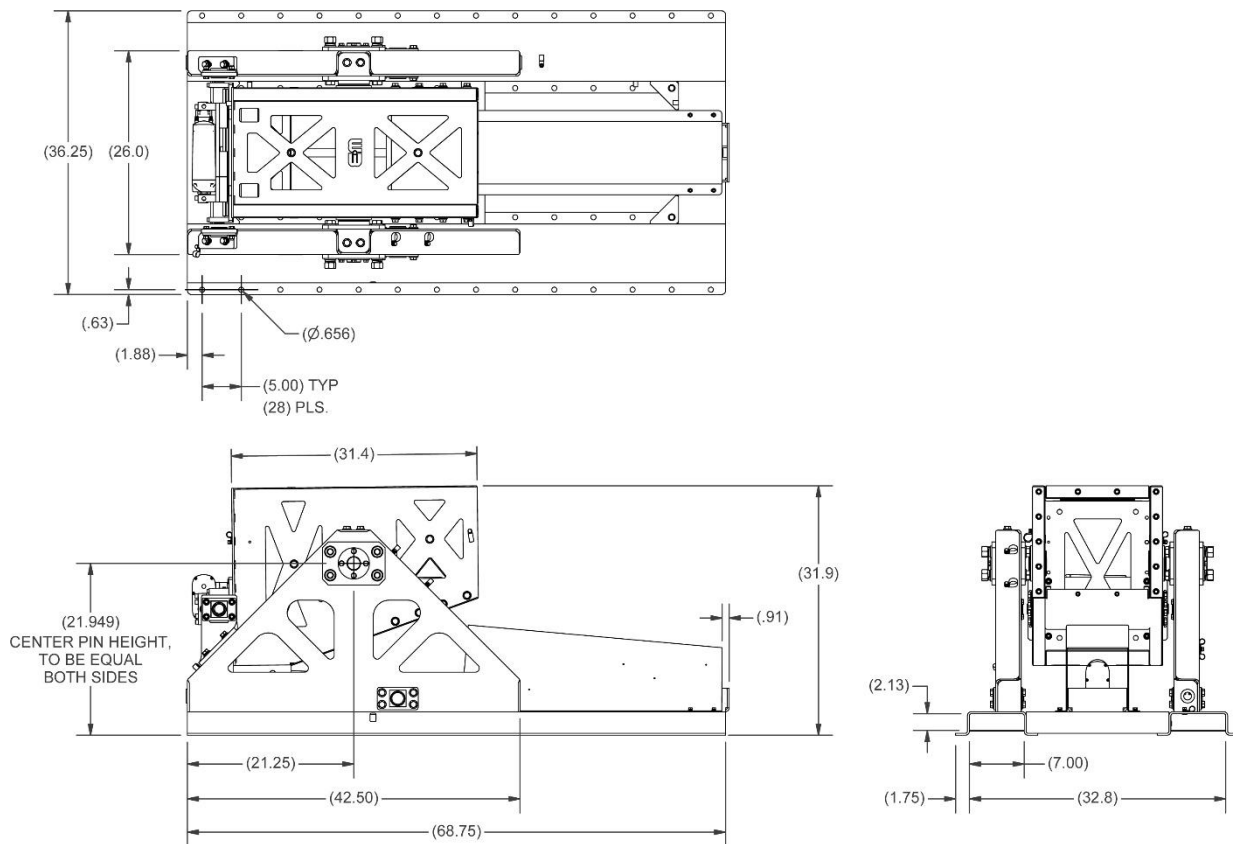


Figure 2-1 AMTS 150 Dimensions

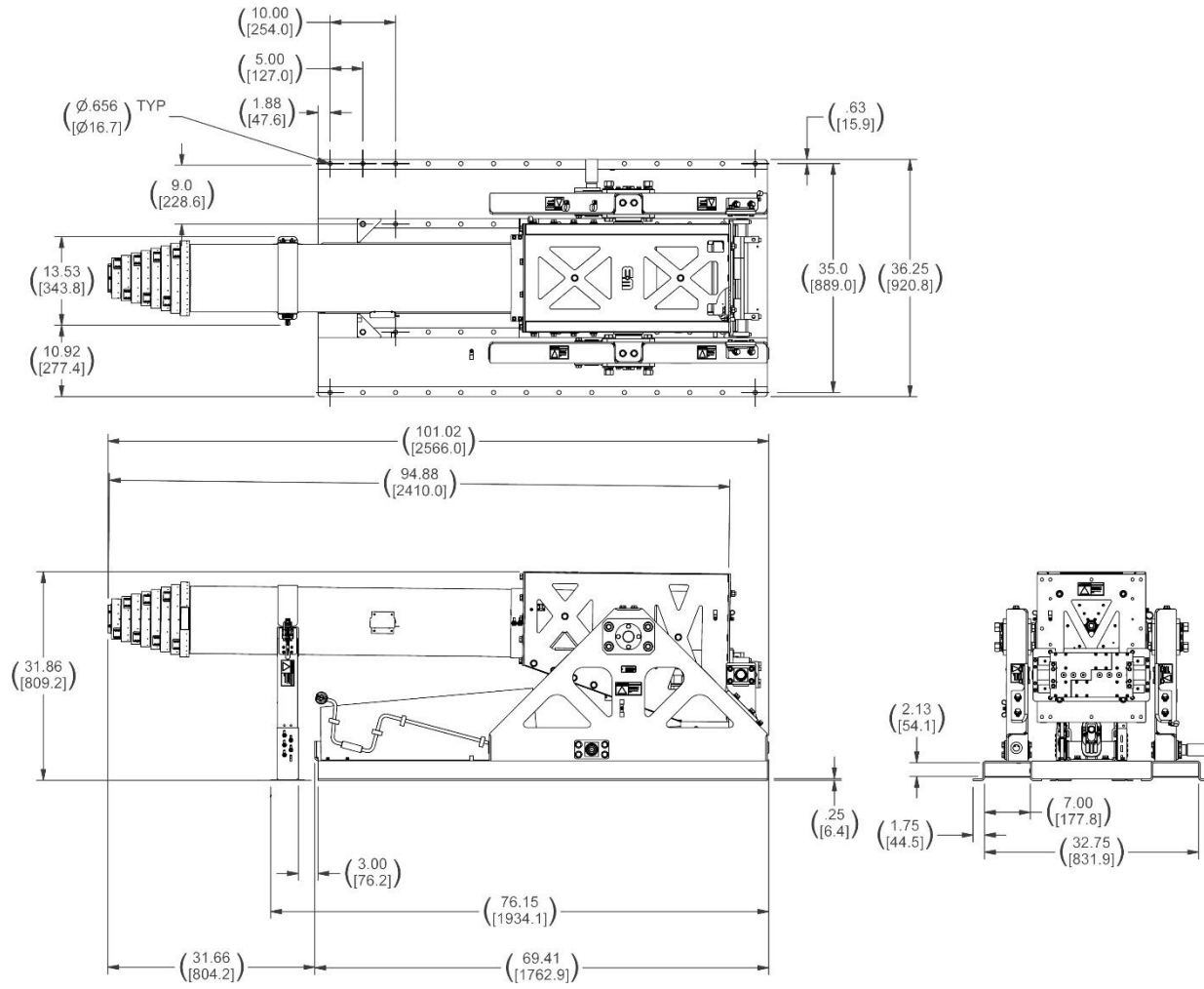


Figure 2-2 AMTS 150 with 15 Meter Stiletto Dimensions



## 2.4 AMTS 150 Installation

This section describes installation of the system. The exact installation procedures may vary based on the configuration of the AMTS 150 and the installation environment. Use the best and safest method for your circumstances.

These instructions assume the mounting hole locations are not pre-drilled and that the components will be used as templates to drill these holes during installation. Alternatively, the mounting hole locations could be found and pre-drilled using the installation dimensions (Section 2.3). When pre-drilling the mounting holes, use care to ensure the mounting holes properly align.

### 2.4.1 Select a Suitable Mounting Location

To select a suitable mounting location, consider the following:

- The mounting structure must have sufficient room to mount the system.
- The mounting structure must be level in all directions, solid, and capable of holding the forces required by the bolts. Check the strength and rigidity of the mounting structure where the system is to be attached. Reinforce as necessary.
- Cables will need routed between components of the system as follows:
  - AMTS 150 to Control Box
  - Mast to Control Box
  - Customer Power to Control Box
  - HHRC to Control Box (Optional)
  - CANBUS Control to Control Box (Optional)

### 2.4.2 Unpack the System

During installation, it will be necessary to lift the system. The AMTS 150 has formed channels designed to accept the forks of a lift truck for transportation during installation. These instructions assume this method of lifting the system. Depending on the environment and equipment available, other methods may work better. Use the best and safest method for your circumstances.

**⚠ WARNING**

**Safety Instruction – Observe Proper Procedures!** Use extreme caution while lifting the system and when system is suspended to avoid injury and equipment damage. Be certain the system is properly secured. All operators should be aware of and follow the applicable local, regional, and national standards and codes of practice for slinging and transporting equipment. Never lift system over people. Ensure lifting equipment including, but not limited to, lifting straps and hoist, are capable of handling the forces generated from lifting the system. Observe manufacturer instructions on lifting equipment. Death or serious injury could result if proper procedures are not followed.

Unpack the system as follows:

1. Carefully open the shipping crate.
2. Inspect for any shipping damage. Notify the carrier if damage is evident.
3. Remove all loose components.
4. Dismantle the shipping crate so that the lifting truck can access the system (Figure 2-3).

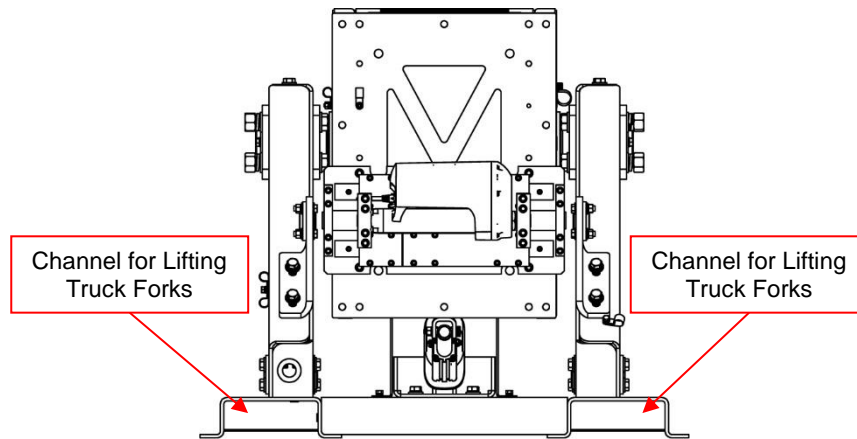


Figure 2-3 Lifting Points

5. Using the lifting truck, carefully lift the system.
6. Carefully maneuver the system to the desired mounting location. The operator should be able to view the system at all times to ensure the mast does not collide with any obstructions.
7. Slowly lower the system until the system is on the mounting surface and the weight of the system has settled.
8. Ensure the system is temporarily secured to prevent it from tipping over during the installation process.

### 2.4.3 Install AMTS 150

To install the AMTS 150:

1. Carefully position the system in the desired position in the mounting location.
2. Ensure the system is level in all directions. If necessary, shims may be added to correct the alignment. It is necessary to check the system in two places 90° apart when leveling.
3. Mounting holes have been provided along the channels on each side of the AMTS 150 (Figure 2-4). Use the mounting holes as a template to drill holes in the mounting surface. At least 4 evenly spaced mounting holes on each channel (8 mounting holes total) should be used.

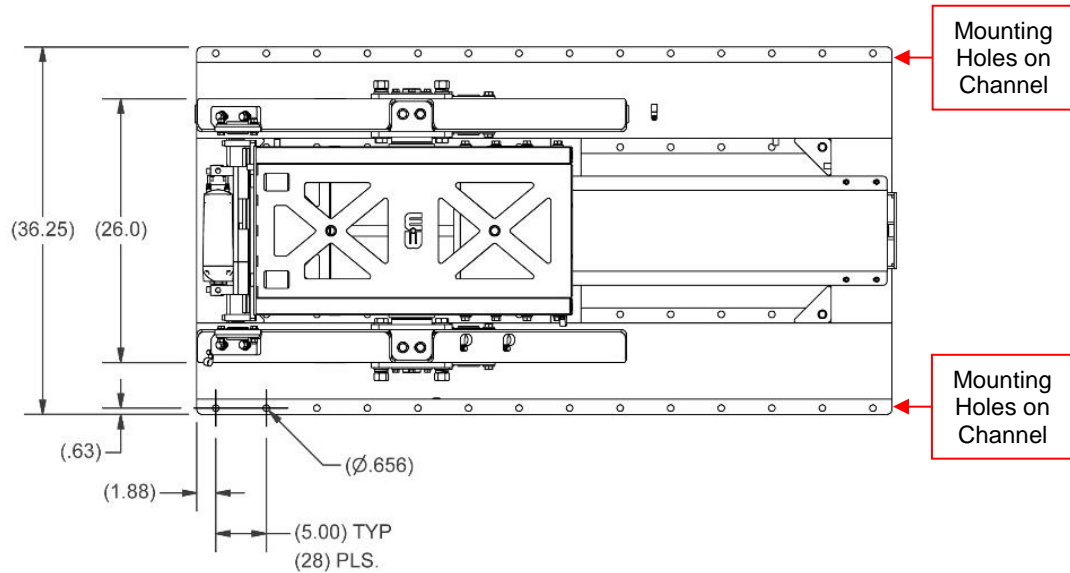


Figure 2-4 Mounting Holes

4. Secure the system in position. Torque all hardware as appropriate for its size and grade. The mounting hardware must include proper means to resist vibration loosening such as thread-locking compound or locking hardware. Ensure the system remains level as it is torqued.

### 2.4.4 Install Support Bracket

When installing the Support Bracket, ensure the payload is NOT installed.

To install the Support Bracket:

1. Clamp the Support Bracket to the mast so that the Support Bracket points down towards the mounting surface.
2. Loosely connect the Support Bracket foot to the Support Bracket.
3. Ensure the Support Bracket foot is level. If necessary, shims may be added to correct the alignment. It is necessary to check the system in two places 90° apart when leveling.
4. Secure the Support Bracket foot in position. Torque all hardware as appropriate for its size and grade. The mounting hardware must include proper means to resist vibration loosening such as thread-locking compound or locking hardware. Ensure the Support Bracket foot remains level as it is torqued.
5. If necessary, adjust the connection between the Support Bracket and the Support Bracket foot. Torque all hardware as appropriate for its size and grade. The mounting hardware must include proper means to resist vibration loosening such as thread-locking compound or locking hardware.

## 2.4.5 Install Control Box

The Control Box may be installed outside or inside an enclosure such as the cab of a vehicle.

To install the Control Box:

1. Using the Control Box as a template, drill six M6 (1/4 inch) holes into the mounting structure.

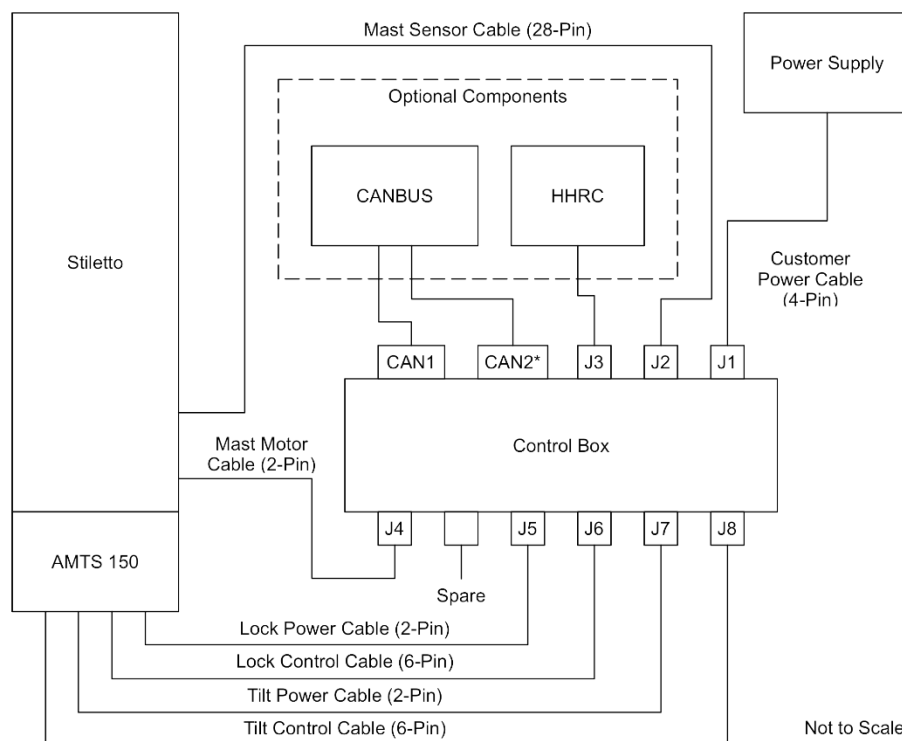
Note: The Control Box has seven mounting holes. It is only necessary to use six of the mounting holes to secure the Control Box.

2. Secure the Control Box using six M6 (1/4 inch) stainless steel fasteners. Torque all hardware as appropriate for its material and size. The mounting hardware must include proper means to resist vibration loosening such as thread-locking compound or locking hardware.
3. Use 10-32 UNF-2B hardware and a Ground Strap to ground the Control Box from the designated ground location to the chassis of the vehicle or a known earth ground. The ground location on the Control Box is designated with the electrical ground label.

## 2.4.6 Electrical Installation

To electrically install the system:

1. Refer to Figure 2-5 for an overview of the system wiring.



\* Note: If the Control Box is configured as an End Node, the user must install a 120 ohm resistor between point A and point C on the CAN2 connector.

Figure 2-5 AMTS 150 Wiring

2. Run the Mast Motor and Mast Sensor Cables from the mast to the Control Box. Plug the Mast Motor Cable into J4 and the Mast Sensor Cable into J2 on the Control Box. Screw both connectors in place so that the cables are secure.
3. Run the Lock Power and Lock Control Cables from the Lock Pin Actuator to the Control Box. Plug the Lock Power Cable into J5 and the Lock Control Cable into J6 on the Control Box. Screw both connectors in place so that the cables are secure.
4. Run the Tilt Power and Tilt Control Cables from the Tilt Actuator to the Control Box. Plug the Tilt Power Cable into J7 and the Tilt Control Cable into J8 on the Control Box. Screw both connectors in place so that the cables are secure.
5. If the HHRC is to be used, plug the HHRC into J3 on the Control Box. Screw the connector in place so that the cable is secure.
6. If CANBUS is to be used, run the CANBUS Cables to CAN1 and CAN2. If the Control Box is configured as an End Node, then the user must install a 120 ohm resistor between point A and point C on the CAN2 connector. Plug the cables in and screw the connectors in place so that the cables are secure.

### 2.4.7 Connect Power to the System

Power and handshake lines enter the Control Box through bulkhead connector J1. The Will-Burt Company supplies a 9-pin Power Cable Connector to connect to J1. The customer is responsible for integrating 10-gauge power lines (with optional ground) and any handshake lines into the Power Cable Connector. With cable runs longer than three meters (10 feet), a lower gauge wire will be needed.

The system does not have a master power switch. If a master power switch is desired, the customer must provide it with the source power.

To connect customer power to the system:

1. Wire the Power Cable Connector according to Figure 2-6.

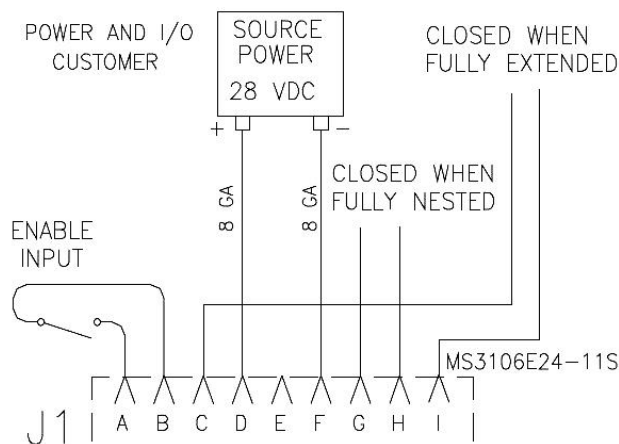


Figure 2-6 Power Cable Connector Wiring

2. Plug customer power into J1 on the Control Box. Screw the connector in place so that the cable is secure.

## 2.5 Test the Installation

Follow all precautions while testing system installation.

**⚠ CAUTION**

**Equipment Damage!** Verify that a power source capable of delivering the specified system voltage and current has been properly connected to the Control Box.

**⚠ CAUTION**

**Polarity!** Ensure the electrical mains polarity is correct before initializing the system.

To test the installation:

1. Review the Pre-Operation Check.
2. Prepare the system for operation.
3. Raise and extend the mast.
4. Retract and lower the mast.

See Section 3 for additional details on these procedures.

## Section 3 Operation

This section describes operation of the AMTS 150. The exact operating procedures may vary based on the configuration of your AMTS 150. Follow the appropriate operation procedures for your AMTS 150. Use care to understand and follow all precautions while operating.

### 3.1 Pre-Operation Check

Before operating the system, ensure:

- All operators read and understand the entire operation procedure
- The system is properly installed.
- The payload is properly installed.
- The s is undamaged. If damage is apparent, do not use the system, and have it serviced prior to use.
- All electrical cables are undamaged and properly terminated.
- Any transit tie-downs on the payload have been removed.
- When using a vehicle, that the vehicle is not moving and is on level terrain.
- Ensure that the following precautions are understood and followed:

**⚠ WARNING**

At all times prior to system operation you shall ensure that:

- The tilting system pivot path is free of personnel and mechanical obstruction.
- All electrical cables are undamaged and properly terminated.
- The control is receiving proper voltage and current.
- The mast assembly and payload are properly installed.
- Any transit tie-downs on the tilting system, mast assembly and payload have been removed.
- The vehicle is not moving.
- The area above the tilting system is free of mechanical obstructions. Striking an overhead obstruction can damage the payload and/or the tilting system.
- Ensure the area above the tilting system is free of electrical wires. Operator death may occur by pivoting the system and/or extending the mast into power lines.

**⚠ CAUTION**

Deviation from standard operating conditions could cause tilting system and/or mast failure.

## 3.2 Operation Equipment

Table 3-1 lists recommended equipment for operation.

*Table 3-1 Equipment Recommended for Operation*

Recommended Equipment*			
Personal Protective			
	Safety Glasses	Work Gloves	Nitrile or Vinyl Gloves
	Hearing Protection	Hard Hat or Helmet	Safety Shoes
Hand Tools (For manual operation only)			
	Long Crank Handle Assembly (P/N: 5339103)	6 mm Hex Wrench	
* Depending on the local, regional, and national standards and codes of practice, and the environment, additional personal protective equipment may be necessary.			

## 3.3 Powered Operation

This section describes powered operation using the Control Box or HHRC.

If an emergency stop is required at any time, press the Emergency Stop Button on the Control Box. This will cause all mast and tilt system motion to stop.

### 3.3.1 Prepared the System for Powered Operation

To prepare the system for powered operation:

- Ensure the system is stationary on level, stable ground.
- Perform the Pre-Operation Check (Section 3.1).
- If necessary, remove any transit tie-downs.
- If necessary, secure any cables to the mast.
- If necessary, secure the payload to the mast.
- If necessary, supply power to the system.

The system is now operational.



### 3.3.2 Raise and Extend the Mast

To raise the mast to the vertical (90°) position and extend it:

1. Unlock the Support Bracket and open the Support Bracket.
2. Push back the switch guard covering the UP/DOWN Switch (Figure 3-1).



Figure 3-1 UP/DOWN Switch

3. Hold the UP/DOWN Switch on the Control Box or HHRC in the UP position (Figure 3-1). With the switch held in the UP position, the mast will move through the following sequence:
  - a. The locking pins will retract, unlocking the tilt system.
  - b. The tilt system will pivot the mast from the horizontal (0°) position to the vertical position.
  - c. The locking pins will extend, locking the tilt in the vertical position.
  - d. The mast will automatically extend from the nested position to the extended position. As long as the UP/DOWN Switch is held in the up position, the mast will extend and the Display will show the appropriate intermediate extension height. Be sure to stay clear of the collars during operation as they create a pinch point hazard. The mast will automatically stop extending when it reaches the fully extended height limit.

4. Release the UP/DOWN switch when the desired height is reached.

If the UP/DOWN Switch is released before the maximum extension is reached, the mast will quickly stop and the display will show the current extension.

If the UP/DOWN Switch is held long enough, the mast will automatically stop when the Full Extension Limit Switch is reached and the display will show "DEPLOYED".

5. Push the switch guard back into position to protect the UP/DOWN Switch.

### 3.3.3 Raise and Extend the Mast with OVERRIDE Switch

The OVERRIDE Switch is used with the UP/DOWN Switch to ignore any errors returned by the Control Box in order to extend and retract the mast. Only use the OVERRIDE Switch for emergency operation of the mast.

**⚠ CAUTION**

**Equipment Damage – Overriding Sensor and Faults!** Only use OVERRIDE Switch for emergency operation of mast. When the OVERRIDE Switch is engaged, all sensors and faults generated by the controls of the mast are ignored. Power to the Motor will continue as long as the OVERRIDE Switch is held, even at the extreme high and low ends of travel. The limit switches typically used to prevent the mast from over-travelling at the extreme ends of travel will not function normally. Use extreme caution when using the OVERRIDE Switch at the fully extended and fully nested areas of mast deployment. Holding the UP/DOWN Switch beyond the limits of travel may result in equipment damage.

When using the OVERRIDE Switch to extend the mast:

1. Unlock the Support Bracket and open the Support Bracket.
2. Push back the switch guards covering the OVERRIDE Switch and the UP/DOWN Switch (Figure 3-2).



Figure 3-2 OVERRIDE Switch

3. Hold the OVERRIDE Switch in the engage position and hold the UP/DOWN Switch in the UP position. The system will ignore any errors and move through the following sequence:
  - a. The locking pins will retract, unlocking the tilt system.
  - b. The tilt system will pivot the mast from the horizontal (0°) position to the vertical (90°) position.
  - c. The locking pins will extend, locking the tilt in the vertical position.
  - d. The mast will automatically extend from the nested position to the extended position. As long as both switches are held, the mast will extend and the Display will show the appropriate intermediate extension height. Be sure to stay clear of the collars during operation as they create a pinch point hazard.
4. Release the UP/DOWN Switch and OVERRIDE Switch when the desired height is reached.
5. Push both switch guards back into position to protect the UP/DOWN and OVERRIDE Switches.

### 3.3.4 Retract and Lower the Mast

To retract the mast and lower it to the horizontal (0°) position:

1. Push back the switch guard covering the UP/DOWN Switch.
2. Hold the UP/DOWN Switch on the Control Box or HHRC in the DOWN position. With the switch in the DOWN position, the mast will move through the following sequence:
  - a. The mast will retract. As long as the UP/DOWN Switch is held in the down position, the mast will retract and the display will show the appropriate intermediate extension height. Be sure to stay clear of the collars during operation as they create a pinch point hazard.
  - b. When the mast is fully retracted, the locking pins will retract, unlocking the tilt system.

If the UP/DOWN Switch is released before the nested position is reached, the mast will quickly stop and the display will show the current extension.

If the UP/DOWN Switch is held long enough, the mast will automatically stop when the Full Nested Limit Switch is reached and the display will show "NESTED".
  - c. The tilt system will pivot the mast from the vertical (90°) position to the horizontal position.
  - d. The locking pins will extend, locking the mast in the horizontal position.
3. Release the UP/DOWN Switch when the tilt system is fully nested.
4. Push the switch guard back into position to protect the UP/DOWN Switch.
5. Close the Support Bracket and re-lock the latch to secure the mast in position.

### 3.3.5 Retract and Lower the Mast with OVERRIDE Switch

The OVERRIDE Switch is used with the UP/DOWN Switch to ignore any errors returned by the Control Box in order to extend and retract the mast. Only use the OVERRIDE Switch for emergency operation of the mast.

**⚠ CAUTION**

**Equipment Damage – Overriding Sensor and Faults!** Only use OVERRIDE Switch for emergency operation of mast. When the OVERRIDE Switch is engaged, all sensors and faults generated by the controls of the mast are ignored. Power to the Motor will continue as long as the OVERRIDE Switch is held, even at the extreme high and low ends of travel. The limit switches typically used to prevent the mast from over-travelling at the extreme ends of travel will not function normally. Use extreme caution when using the OVERRIDE Switch at the fully extended and fully nested areas of mast deployment. Holding the UP/DOWN Switch beyond the limits of travel may result in equipment damage.

When using the OVERRIDE Switch to retract the mast:

1. Push back the switch guards covering the OVERRIDE Switch and the UP/DOWN Switch.
2. Hold the OVERRIDE Switch in the engage position and hold the UP/DOWN Switch in the down position. The system will ignore any errors and move through the following sequence:
  - a. The mast will retract. As long as the UP/DOWN Switch is held in the down position, the mast will retract and the display will show the appropriate intermediate extension height. Be sure to stay clear of the collars during operation as they create a pinch point hazard.
  - b. When the mast is fully retracted, the locking pins will retract, unlocking the tilt system.

If the UP/DOWN Switch is released before the nested position is reached, the mast will quickly stop and the Display will show the current extension.

If the UP/DOWN Switch is held long enough, the mast will automatically stop when the Full Nested Limit Switch is reached and the Display will show "NESTED".
  - c. The tilt system will pivot the mast from the vertical (90°) position to the horizontal (0°) position.
  - d. The locking pins will extend, locking the mast in the horizontal position.
3. Release the UP/DOWN Switch and OVERRIDE Switch when the tilt system is fully nested.
4. Push both switch guards back into position to protect the UP/DOWN and OVERRIDE Switches.
5. Close the Support Bracket and re-lock the latch to secure the mast in position.

## 3.4 Manual Operation

This section describes manual operation of the system. Manual operation is typically only used for emergency operation when power to the system has been lost.

**⚠ WARNING**

**Safety Instruction!** Voltage may be present which can cause severe electrical shock. Always ensure that all electrical circuits to the tilt system are de-energized and properly tagged during manual operation.

**⚠ WARNING**

**Safety Instruction!** Do not electrically energize the mast or tilt system when manually operating the tilt system. Ensure that all electrical circuits to the mast and tilt system are de-energized and properly tagged to prevent injury during manual operations.

**⚠ CAUTION**

Use care when manually raising or lowering the tilt system as normal stops and protections are being bypassed.

### 3.4.1 Prepare the System for Manual Operation

To prepare the system for manual operation:

- Ensure the system is stationary on level, stable ground
- Perform the Pre-Operation Check (Section 3.1)
- Ensure power is removed from the system. Do not manually operate the system with power applied to the system.
- Ensure the Long Crank Handle Assembly and a 6 mm hex wrench are available

The system is now operational.

### 3.4.2 Raise the Mast to the Vertical (90°) Position

To manually raise the mast to the vertical position:

1. Ensure all power has been disconnected from the system.
2. Remove the 6 mm hex head plug on the end of the Lock Pin Actuator (Figure 3-2).

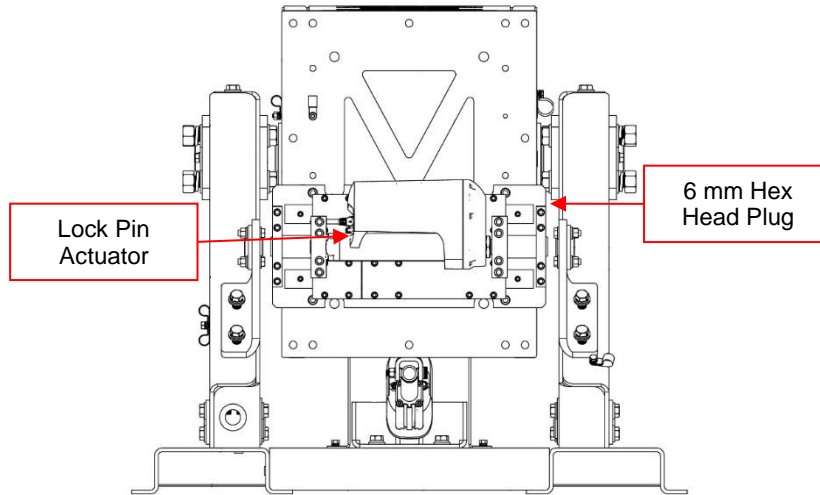


Figure 3-2 Lock Pin Actuator

3. Place a 6 mm hex head wrench into the hole to reach the manual drive.
4. Turn the hex head wrench clockwise until the lock pins retract and the tilt system is unlocked.
5. Remove the 6 mm hex head plug on the end of the Tilt Actuator (Figure 3-3).

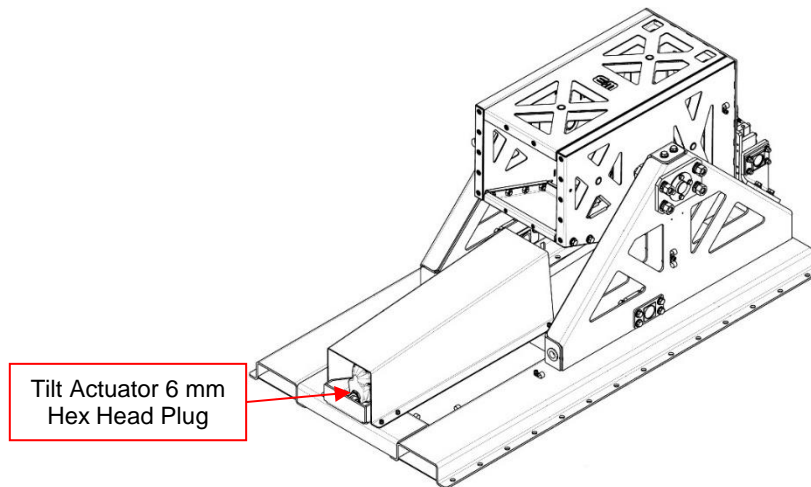


Figure 3-3 Tilt Actuator

6. Place a 6 mm hex head wrench into the hole to reach the manual drive.
7. Turn the hex head wrench clockwise to raise the tilt system. Raise the tilt system until it is in the vertical position.
8. Insert a long 6 mm hex head wrench through the access hole in the tilt system support structure to the lock pin actuator (Figure 3-4).

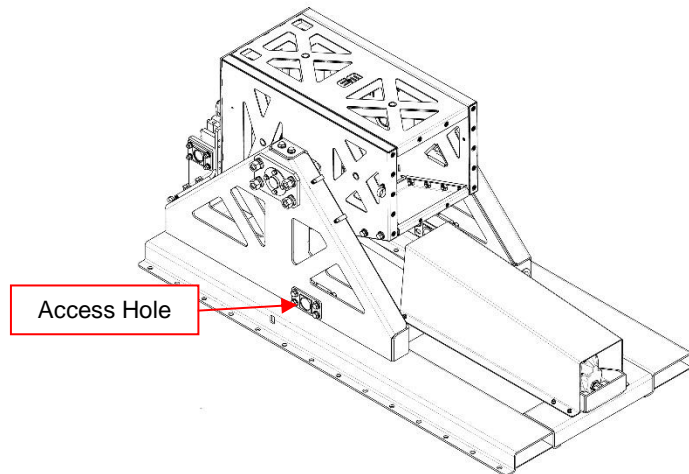


Figure 3-4 Access Hole

9. Turn the hex head wrench counterclockwise until the lock pins extend and the tilt system is locked in the vertical position.

### 3.4.3 Extend and Retract the Mast

When the mast is not powered, the motor leads are not shorted together, thus disabling dynamic braking. The normal limit switches are not in effect during manual operation. There are mechanical hard stops just beyond both the upper and lower limit switch locations that will stop the mast safely. However, it is good practice to stop the mast at the normal positions.

Be sure to stay clear of the collars during operation as they create a pinch point hazard.

To extend the mast manually:

1. Ensure the mast is not powered.
2. Insert the Long Crank Handle Assembly in the manual crank point.

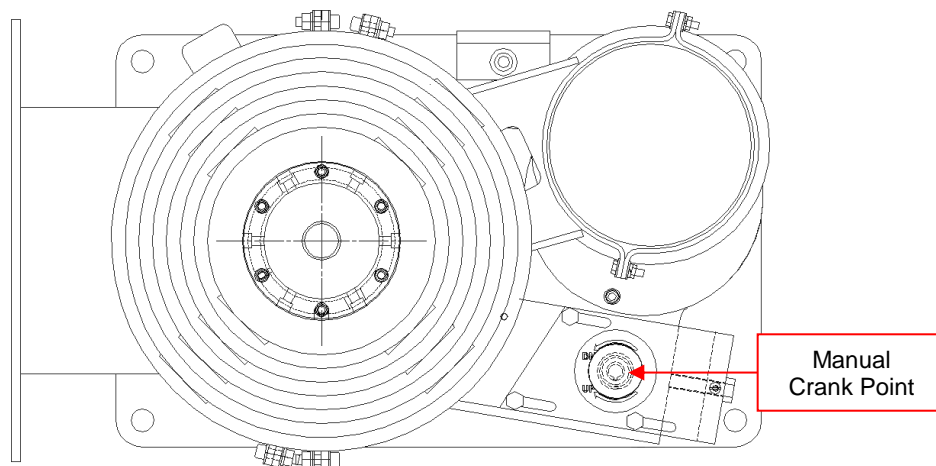


Figure 3-3 Manual Crank Point



3. Use the Long Crank Handle Assembly to:
  - a. Extend the mast by turning the Long Crank Handle Assembly clockwise.
  - b. Retract the mast by turning the Long Crank Handle Assembly counterclockwise.

### 3.4.4 Lower the Mast to the Horizontal (0°) Position

To manually lower the tilt system:

1. Ensure all power has been disconnected from the system.
2. Ensure the mast is fully nested. If necessary, lower the mast (Section 3.4.3).
3. Insert a 6 mm hex head wrench through the access hole in the tilt system support structure to the Lock Pin Actuator (Figure 3-5).

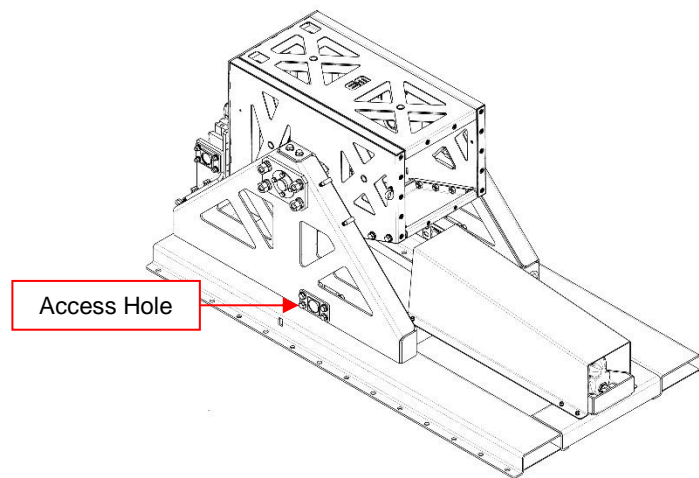


Figure 3-5 Access Hole

4. Remove the 6 mm hex head plug on the end of the Lock Pin Actuator.
5. Place a 6 mm hex head wrench into the hole to reach the manual drive.
6. Turn the hex head wrench clockwise until the lock pins retract and the tilt system is unlocked.
7. Remove the 6 mm hex head plug on the end of the Tilt Actuator.
8. Place a 6 mm hex head wrench into the hole to reach the manual drive.
9. Turn the hex head wrench counterclockwise to lower the tilt system. Lower the tilt system until the tilt system is in the horizontal position.
10. Insert a 6 mm hex head wrench into the hole on the Lock Pin Actuator.
11. Turn the hex head wrench counterclockwise until the lock pins extend and the tilt system is locked in the horizontal position.



## Section 4 Transportation

Before transporting the system, the system needs to be secured. The exact procedures for transportation will vary based on the system configuration. The process described in this manual represents a possible method of transporting the system. Depending on the environment and equipment available, other methods may work better. Use the best and safest method for your circumstances.

**⚠ WARNING**

**Relocation Hazard!** Do not relocate the system during operation or while mast is extended. Do not move vehicle until the mast has been securely nested. This applies especially to vehicle-mounted masts. The payload must be supported or removed prior to driving the vehicle to prevent damage to the mast and payload.

**⚠ CAUTION**

**Safety Instruction – Mast Access!** The operator must provide safe means to access the top of the mast during installation and removal of the payload.

### 4.1 General Transportation

To prepare the system for transportation:

1. Ensure the mast is fully nested, the tilt system is fully in the horizontal (0°) position, and the mast is secured in the Support Bracket. Always visually confirm the mast is fully retracted before moving the mast.
2. Remove power from the system to eliminate the possibility of inadvertent operation of the system.
3. Ensure the payload is removed, supported, or otherwise isolated from the top tube to prevent damage to the mast and payload.

Note: The operator should always visually confirm the mast is entirely retracted

## 4.2 Shipping

When shipping the system, The Will-Burt Company recommends shipping the system in the original shipping crate. If the original shipping crate is not available, contact The Will-Burt Company to order a replacement.

**⚠ WARNING**

**Safety Instruction – Observe Proper Procedures!** Use extreme caution while lifting the system and when the system is suspended to avoid injury and equipment damage. Be certain the system is properly secured. All operators should be aware of and follow the applicable local, regional, and national standards and codes of practice for slinging and transporting equipment. Never lift the system over people. Ensure lifting equipment including, but not limited to, lifting straps and hoist, are capable of handling the forces generated from lifting the system. Observe manufacturer instructions on lifting equipment. Death or serious injury could result if proper procedures are not followed.

When shipping:

1. As necessary, remove the payload.
2. As necessary, prepare the system for transportation (Section 4.1).
3. As necessary, uninstall the system from the mounting structure (Section 2).
4. Properly secure the system in the shipping crate:

## Section 5 Maintenance

This section describes maintenance procedures required to keep the system operational. Use care to understand and follow all precautions while performing these procedures.

### 5.1 Pre-Maintenance Check

Before performing maintenance procedures, ensure the following precautions are understood and followed:

**⚠ WARNING**

**Safety Instruction!** Always turn off power before servicing the mast or tilt system.

**⚠ WARNING**

**Tip Over Hazard!** Before performing maintenance or repair, ensure that the mast and tilt system are level and secure. Injury to personnel or damage to equipment could occur if the mast or tilt system tip over.

### 5.2 Maintenance Equipment

Table 5-1 lists recommended equipment for maintenance.

*Table 5-1 Equipment Recommended for Maintenance*

Recommended Equipment*			
Personal Protective			
	Safety Glasses	Work Gloves	Nitrile or Vinyl Gloves
	Hearing Protection	Hard Hat or Helmet	Safety Shoes
Hand Tools			
	Paint Brushes	Screwdrivers	Torque Wrench
	Wire Brush	Wrenches	
Equipment			
	Hoist	Sling	
Expendables			
	Non-Abrasive Cleaners (Soap and Water)	Rags (Soft, Clean, and Dry)	Touchup Paint
* Note:			
<ul style="list-style-type: none"> <li>Depending on the local, regional, and national standards and codes of practice, and the environment, additional personal protective equipment may be necessary.</li> <li>When disposing of any disposables or components, do so according to any applicable local, regional, and national standards and codes of practice.</li> </ul>			

### 5.3 Maintenance Schedule

Table 5-2 provides a schedule of preventative maintenance inspections and procedures required to keep the system in good operating condition.

Table 5-2 Preventative Maintenance Schedule

Frequency	Inspection	Action
As Needed  (In salt water environments, clean the system at least every three months.)	<b>Keep Clean</b> – Inspect to ensure the system is kept clean and free from foreign material. Dirt, grease, oil, and debris may cover up a serious problem.	Clean as you work and as needed. Use denatured alcohol on all metal surfaces. Use water when cleaning rubber or plastic material. Use soap and water when cleaning the exterior surfaces. Use a soft, non-abrasive cloth to wipe clean the bezel on the Control Box display.
As Needed	<b>Lubricate</b> – As needed, grease the pivot points to keep operation smooth.	
During Operation	<b>Damage</b> – Inspect for damage before use. During operation, inspect the outer surfaces for damage.	If damage is apparent, do not use the system and have it serviced before use.
During Operation	<b>Binding</b> – During operation, observe system operation for evidence of binding.	Remove any foreign material or obstructions as necessary.
Weekly	<b>Damage</b> – Inspect all visible surfaces for damage.	If damage is apparent, do not use the system and have it serviced before use.
Weekly	<b>Finish</b> – Inspect for bare metal, rust, and corrosion.	Remove any rust or corrosion with a wire brush. Touchup any bare metal with touchup paint.
Weekly	<b>Fasteners</b> – Inspect external fasteners. Look for loose, missing, bent, or broken fasteners. Look for chipped paint, bare metal, or rust around the bolt heads.	Replace any missing or damage hardware. If any hardware is found loose, retighten. If loose fasteners joining major components cannot be tightened, do not use the system and have it serviced before use.
Weekly	<b>Cables</b> – Inspect system cables. Look for cracked, frayed, or broken insulation; bare wires; loose or broken connectors. Ensure the cables and bulkhead connectors are clean, the pins undamaged, and the threads in good condition.	Replace cables as required. Tighten loose connections. If the bulkhead connectors are unable to mate with the corresponding cable, do not use the system and have it serviced before use.

## Section 6 Reference

This section provides reference information for the system as follows:

- Extended Glossary of Terms (Section 6.1)
- CANBUS (Section 6.2)

### 6.1 Extended Glossary of Terms

This section defines terms used within this manual as follows:

- General Terms and Abbreviations (Section 6.1.1)
- Mounting Position Terms (Section 6.1.2)

#### 6.1.1 General Terms and Abbreviations

This section describes general terms and abbreviations used within this manual.

- “AMTS 150” to refer to the Automated Mast Tilt System 150
- “CANBUS” stands for Controller Area Network bus.
- “Extended” refers to the partial- or full-raised position of the mast that the mast pneumatically goes to from the nested position. In the extended position, some or all the tubes have risen.
- “Mast” to refer to the telescoping mast that is installed inside the AMTS 150.
- “Nested” refers to the position of the mast where no tubes have risen. The mast remains retracted. This position is sometimes referred to as “stowed”.
- “Payload” to refer to the object or equipment being raised by the mast to an operational height.
- “P/N” stands for Part Number. These are Will-Burt part numbers for various components in the system.

#### 6.1.2 Mounting Position Terms

For the purposes of this manual, regions of the mounting location are defined as follows:

- “Mounting Structure” is the overall structure where the system is mounted.
- “Mounting Surface” is the surface to which the base of the system is secured.

## 6.2 CANBUS

This section provides information related to CANBUS control of the system.

### 6.2.1 Mast Controller Status Message

1. Message ID
  - a. PGN: 65280 (0xFF00)
  - b. PDU: 2 Proprietary B
  - c. Source: Will-Burt Mast Controller
  - d. Transmit Frequency: 1 per 100 milliseconds

		Identifier 11-bits								Identifier Extension 18-Bits																							
		Priority			R	DP	PDU Format (PF) 6-bits (MSB)						SRE	IDE	PF (cont)		PDU Specific (PS) Mast Status						Source Address						RTR				
		3	2	1			8	7	6	5	4	3			2	1	8	7	6	5	4	3	2	1	8	7	6	5		4	3	2	1
bit		28	27	26	25	24	23	22	21	20	19	18			17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
val		1	1	0	0	0	1	1	1	1	1	1			1	1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
		18						FF						50						80													

Figure 6-1 Will-Burt PDU Proprietary B ID Field (Reference Only)

2. Message Data

Byte 0								Byte 1								Byte 2								Byte 3							
Motor Current High								Motor Current Low								Temperature High								Temperature Low							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Byte 4								Byte 5								Byte 6								Byte 7							
Status Word								Fault Word								Warning Word								Future							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Byte	Field	Description
0	Motor Current High	Fixed point integer representing motor current in 0.1 Amp engineering units
1	Motor Current Low	
2	Temperature High	Fixed point integer representing temperature in 0.1 deg C engineering units
3	Temperature Low	
4	SW Low bit 0	<b>Nested:</b> 1 = active, 0 = inactive
	SW Low bit 1	<b>Extended:</b> 1 = active, 0 = inactive
	SW Low bit 2	<b>Tilt In:</b> 1 = active, 0 = inactive
	SW Low bit 3	<b>Tilt Out:</b> 1 = active, 0 = inactive
	SW Low bit 4	<b>Lock In:</b> 1 = active, 0 = inactive
	SW Low bit 5	<b>Lock Out:</b> 1 = active, 0 = inactive Out
	SW Low bit 6	Future
	SW Low bit 7	Future
5	Fault High bit 0	<b>Limit Switch Conflict:</b> 1 = active, 0 = inactive
	Fault High bit 1	<b>Low voltage:</b> 1 = active, 0 = inactive – Volt < 18.0V
	Fault High bit 2	<b>Motor Current:</b> 1 = active, 0 = inactive – Current > 40A (80A HD Mast)
	Fault High bit 3	Future
	Fault High bit 4	Future
	Fault High bit 5	Future
	Fault High bit 6	Future
	Fault High bit 7	Future
6	Warning High bit 0	<b>Low voltage:</b> 1 = active, 0 = inactive – Volt < 20.0V
	Warning High bit 1	<b>Low Temp:</b> 1 = active, 0 = inactive - Temp < -40.0C
	Warning High bit 2	<b>High Temp:</b> 1 = active, 0 = inactive – Temp < 80.0C
	Warning High bit 3	<b>Temp Sensor:</b> 1 = active, 0 = inactive – Temp < -55.0C or Temp > 125.0C
	Warning High bit 4	
	Warning High bit 5	
	Warning High bit 6	
	Warning High bit 7	
7	Future	

## 6.2.2 Mast Controller Control Message

### 1. Message ID

- a. PGN: 61184 (0xEF00)
- b. PDU: 1 Proprietary A
- c. Source: Customer-Supplied Controller
- d. Transmit Frequency: 1 per 100 milliseconds

Message must be received every 100 milliseconds for continued mast up/down operation in order to achieve failsafe operation.

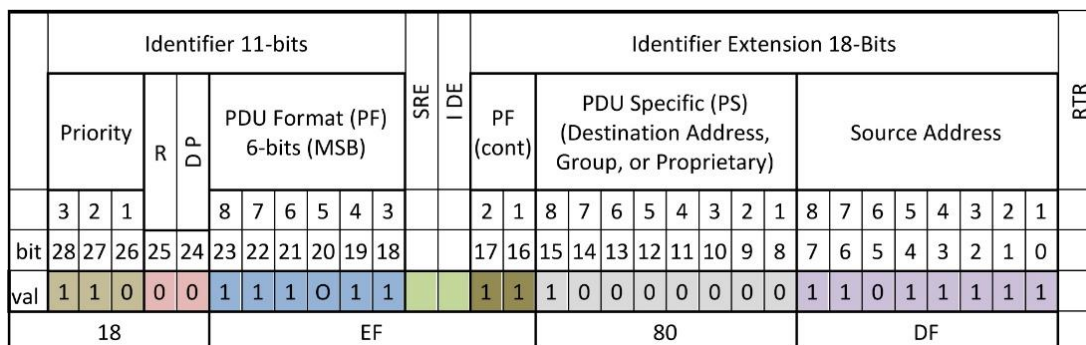


Figure 6-2 Will-Burt PDU Proprietary A ID Field (Reference Only)

### 2. Message Data

Byte 0								Byte 1								Byte 2								Byte 3							
ID								Mast Up Request								Mast Down Request								Future							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Byte 4								Byte 5							
Future								Future							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Byte	Field	Description
0	ID	Message Type ID = 0x01
1	Mast Up Request	STOP_REQUEST = 0x0, RUN_REQUEST = 0x1, ERROR = 0x2, IGNORE = 0x3
2	Mast Down Request	STOP_REQUEST = 0x0, RUN_REQUEST = 0x1, ERROR = 0x2, IGNORE = 0x3
3	Future	
4	Future	
5	Future	