



**“SAM”<sup>®</sup>**  
**(SUB ARC MOGGY)**

**PORTABLE FRICTION  
 DRIVE TRAVEL  
 CARRIAGE**



**MODEL:  
 GM-02-250**



**PARTS LIST  
 &  
 OPERATING INSTRUCTIONS**

Website: [www.gullco.com](http://www.gullco.com)

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## **SAFETY INSTRUCTIONS**

Although the Gullco "SAM<sup>®</sup>" carriage is manufactured for safe and dependable operation, it is impossible to anticipate those combinations of circumstances, which could result in an accident. An operator of this equipment is cautioned to always practice "**Safety First**" during each phase of operation, setup and maintenance.

Read and understand this whole manual before operating or performing service of this equipment. Become familiar with the machines operation, applications and limitations. Keep this manual in a clean and readily available location.

This equipment is normally used to automate / semi-automate welding processes. These processes usually have any combination of the following; bright and hot arcs, flying sparks, fumes, ultraviolet and infrared radiated energy, hot work-pieces, compressed gases, etc.. The onus is on the operator of this equipment to know, understand and follow all the safety precautions associated with the process being used.

A careless operator invites troubles, and failure to follow safety practices may cause serious injury or even death. Important safety precautions are given in the following:

### **Electrical Shock Prevention**

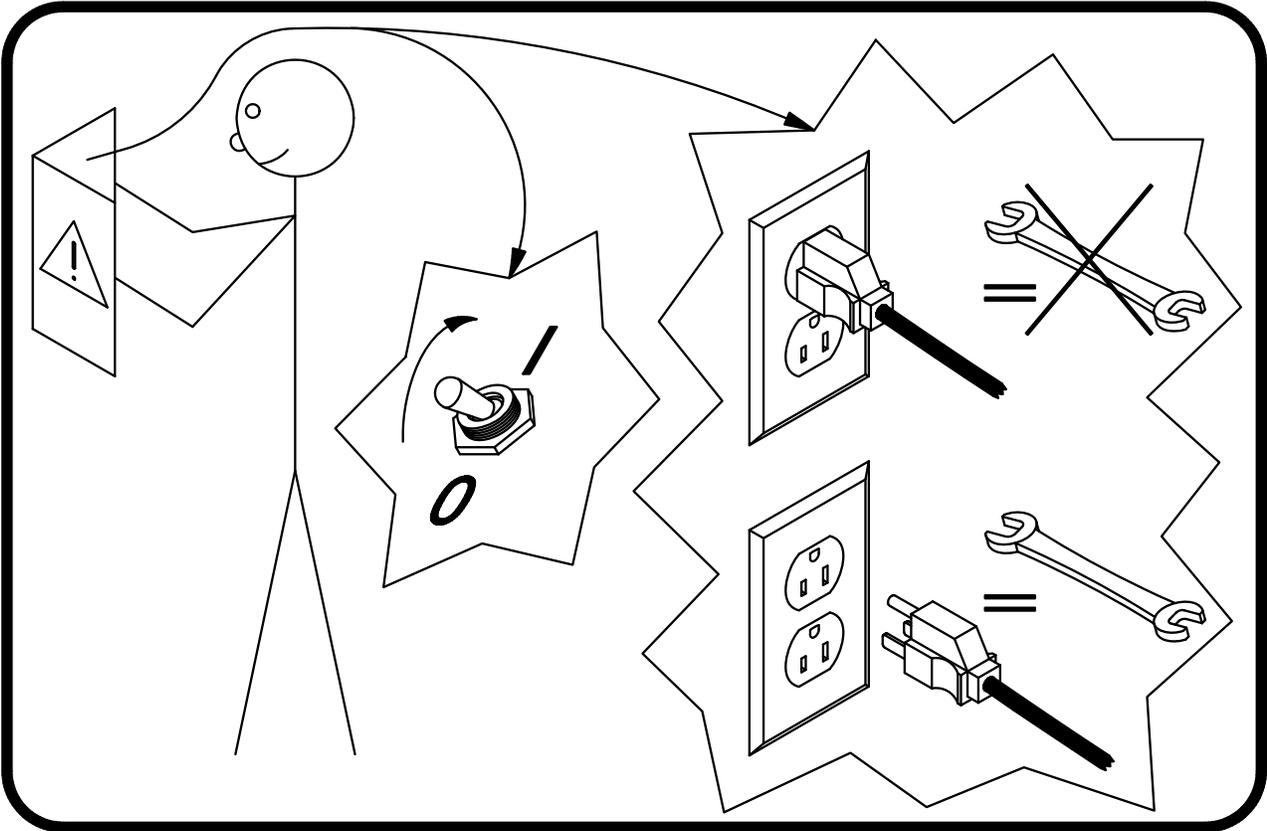
- Do not use this equipment in damp or wet locations.
- Do not expose this equipment to rain.
- Never carry this equipment by the cables or pull the cables to disconnect from the receptacle.
- Keep all cables from heat, oil and sharp edges.
- Inspect all cables periodically and replace if damaged.
- Inspect the security of all cables periodically and repair if loose.
- Disconnect the power cord when not in use.
- Disconnect the power cord **positively** to prevent electrical shock before repair and service of the equipment.

### **Bodily Injury Prevention**

- Do not wear loose clothing, jewellery and loose, long hair, which may get caught into automatic systems or moving parts.
- Keep handles & lifting points dry, clean, free from oil & grease and in good repair.
- Do not operate this equipment if ill or drowsy from medication or fatigue.
- Do not lift this machine if equipped with heavy accessories or welding cables attached.
- Lift machine only with equipment of adequate lifting capacity.
- Never lift or suspend the machine over personnel.
- Always keep this equipment clean and in good working order.
- Report any unsafe condition for immediate correction.

## SAFETY PRECAUTIONS

The following cautionary/warning label is attached to each SAM<sup>®</sup> carriage and its intent is to instruct all those concerned to read the manual before turning the unit on and before performing service. Also, positively disconnect the unit from all power supplies before servicing!



## IMPORTANT

### READ THIS BEFORE OPERATING THE SAM<sup>®</sup> CARRIAGE

Ensure that an adequate and well-maintained weld return path is provided with good electrical contact. Failure to do so may result in the welding current passing through the carriage and damaging the wiring and electrical components.

**ALL THE SAFE PRACTICES AND PRECAUTIONS MAY NOT BE GIVEN IN WRITING. SOME ARE BASED ON COMMON SENSE, BUT OTHERS MAY REQUIRE TECHNICAL BACKGROUND TO EXPLAIN.**



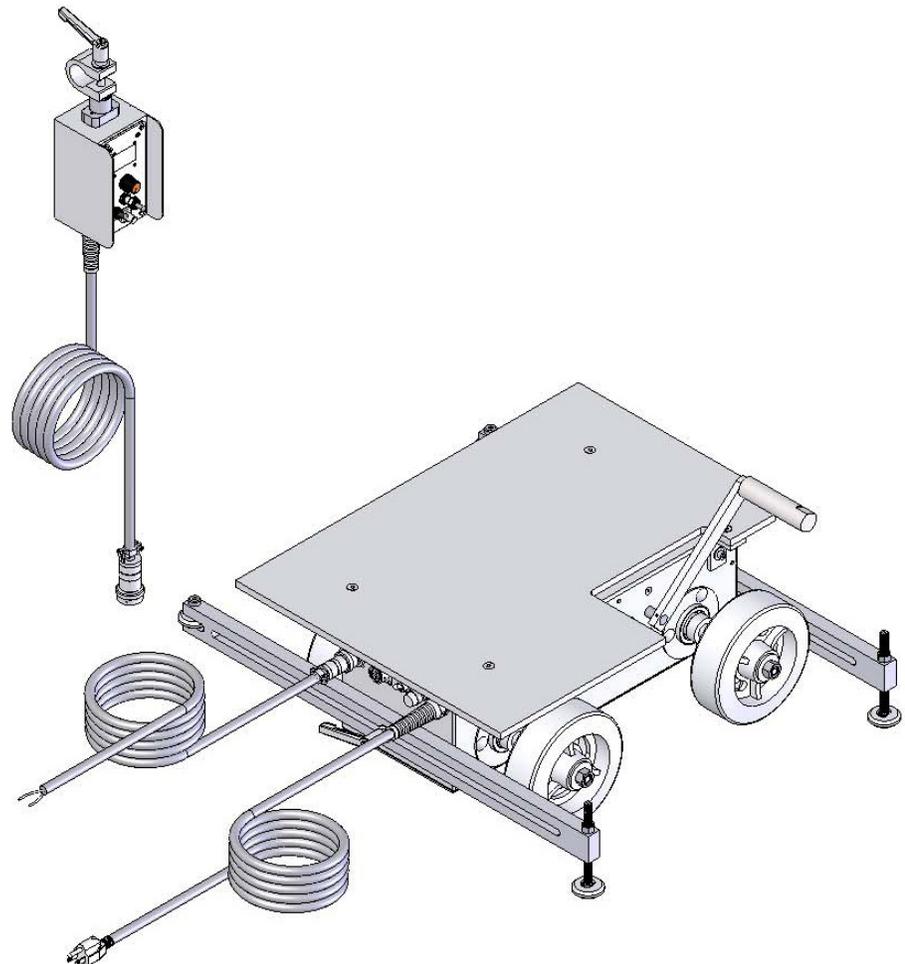
## **SAM® CARRIAGE DETAILS**

This manual covers the parts lists, the operation instructions and the maintenance requirements of the following Gullco SAM® Portable Friction Drive Travel Carriage:

**GM-02-250-A (42 VAC), GM-02-250-B (115 VAC), GM-02-250-C (230 VAC)**

### **MODEL OVERVIEW**

The part number **GM-02-250-(A, B or C)** is used to order a complete GULLCO SAM® sub arc welding carriage system and comes complete with the Gullco carriage, carriage control pendant, mounting plate, guide wheel assemblies.



## SPECIFICATIONS

**Speed Range:** 4 – 66.1 in/min [10 - 168 cm/min]

**Maximum Incline:** 30° Depending on mounting configuration

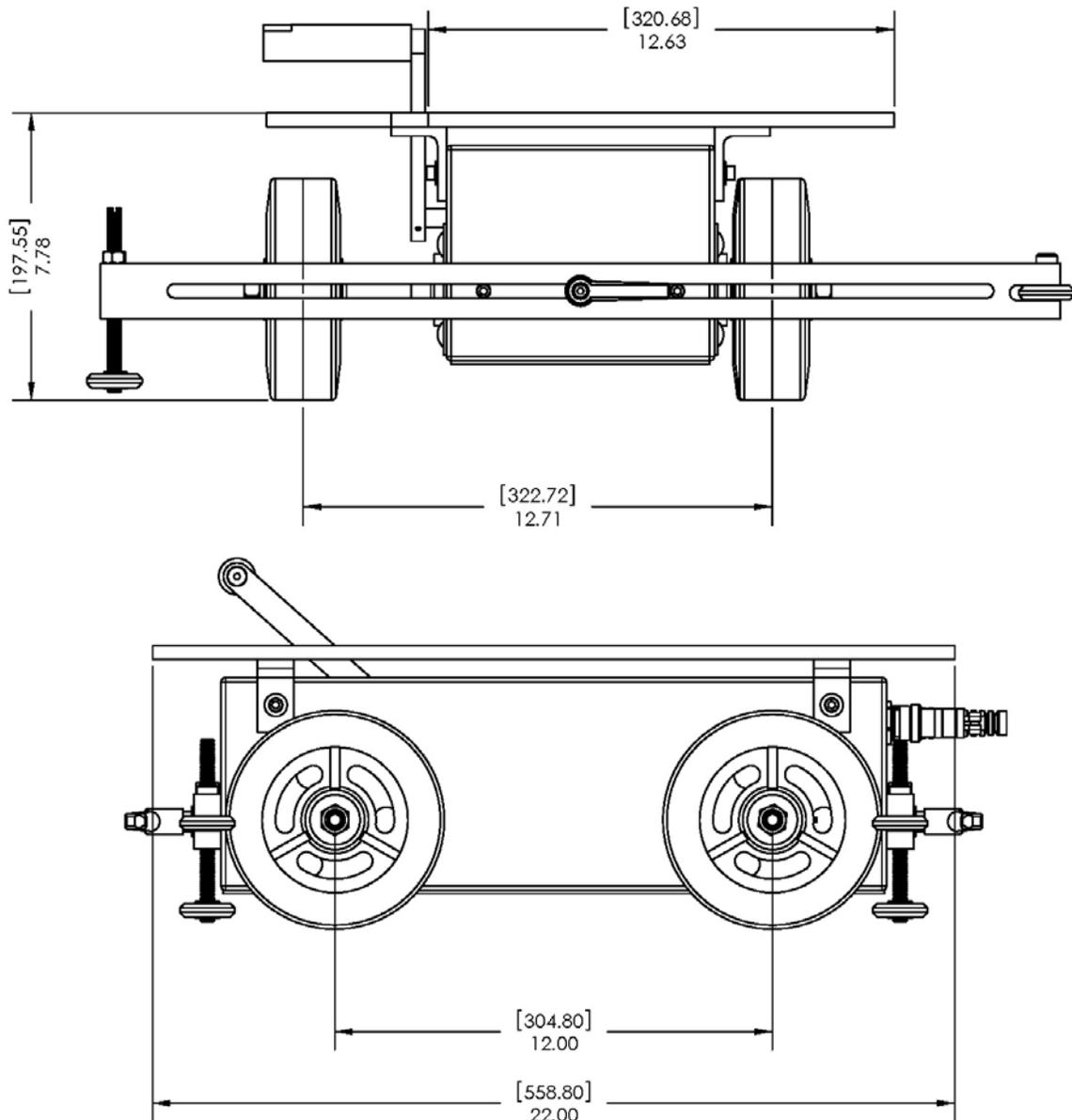
**Supply Voltage:** 42VAC or 115VAC or 230VAC, single phase, 50/60Hz 200 watts

**Drive Motor:** 24 VDC permanent magnet gear motor.

**Weight of GM-02-250 carriage:** 70 Lbs. [31.75 Kg.]

**Complies with:** CE Certification.

## GENERAL DIMENSIONS



## GENERAL DESCRIPTION

The Gullco GM-02-250 SAM<sup>®</sup> carriage is a portable, four wheeled, friction drive, submerged arc welding travel carriage. It is an electrically powered, self propelled carriage that travels in forward and reverse directions at precisely controlled speeds. It consists of a 24 VDC permanent magnet gear motor which engages with the wheel axles through chain and sprocket arrangements which allows both axles to impart a tractive effort through the four rubber tired, friction drive wheels. The motor's clutch mechanism is engaged and disengaged through a foot operated lever.

Safety is greatly enhanced by the use of Gullco's low voltage (24 VDC), highly advanced carriage drive and control system, which incorporate a closed loop tach feedback system to ensure precise carriage travel speeds.

## INTENDED FORESEEN USAGE

The Gullco heavy duty SAM<sup>®</sup> is intended to automate and improve the quality of Submerged Arc welding operations. The SAM<sup>®</sup> is normally guided by adjustable guide wheels which are set to always drive the carriage slightly into the vertical member (usually either the vertical piece of a fillet joint or a template/fence placed parallel to the joint). Using the Gullco SAM<sup>®</sup> travel carriage system will add accuracy and uniformity to welding operations while increasing productivity. Typical applications include shipbuilding, offshore construction, steel fabrication industries, etc...

## ELECTRICAL CONNECTION

**WARNING!** Ensure proper AC earth grounding of the Gullco SAM<sup>®</sup> carriage and all auxiliary equipment (where applicable), before applying power. Failure to do so may invalidate the Gullco Warranty.

The label shown below is typical of the product label applied to the SAM<sup>®</sup> carriage:

 <a href="http://www.gullco.com">www.gullco.com</a>	NEWMARKET, CANADA APPLEBY BRIDGE, ENGLAND CLEVELAND, OH., U.S.A. PUNE, INDIA QUEENSLAND, AUSTRALIA SHANGHAI, CHINA	
<b>MODEL</b>		  
<b>SERIAL #</b>	<b>DATE MM/DD/YYYY</b>	
<b>SUPPLY</b> 115 V ~	<b>50/60 Hz. 1 Ø</b>	
<b>WATTS</b> 200		
<b>FUSE</b> 2.5 AMP, SLOW BLOW		

The sketch below diagrammatically shows the arrangement of the electrical cable connections. Each multi-pin connector is different to prevent incorrect connection:

## OPERATION

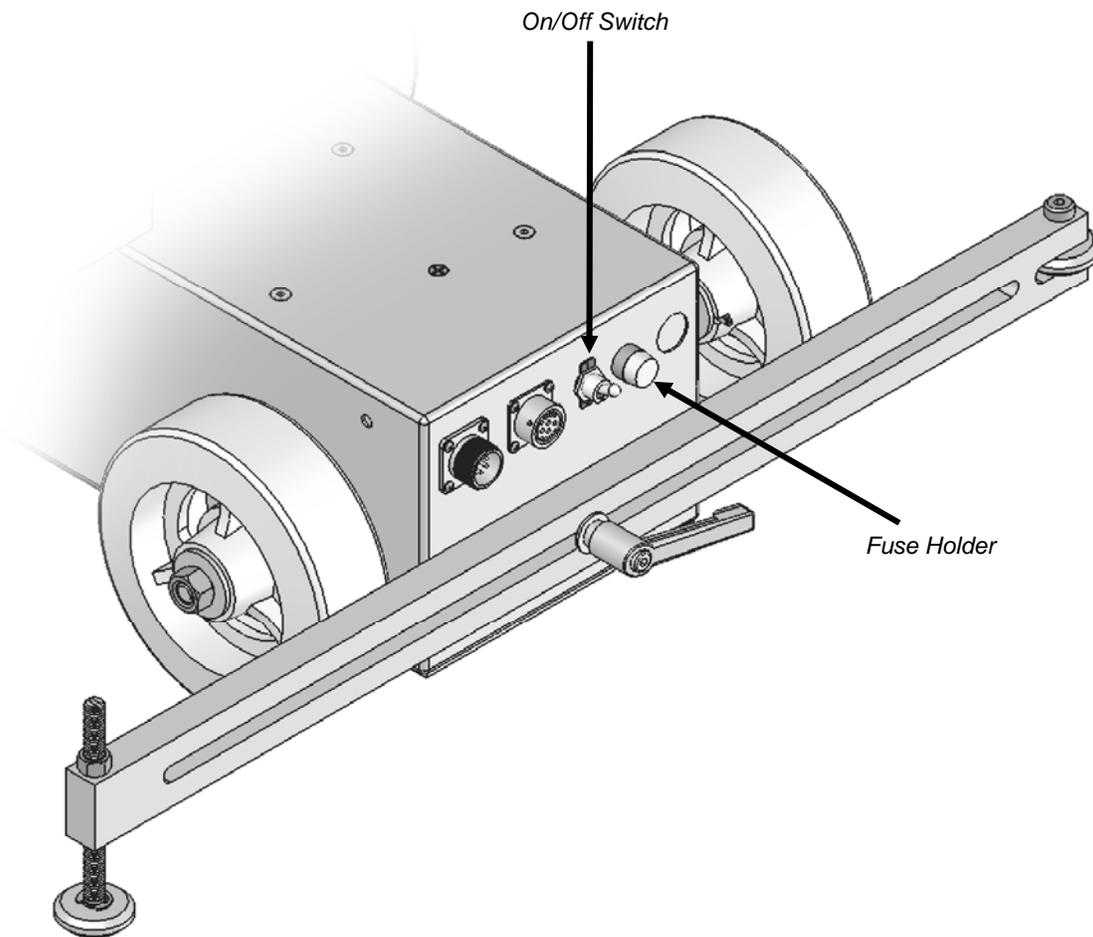
### Local Control Devices

The power On/Off switch is used to disconnect the power to the rest of the control circuitry.

I = on, O = off.

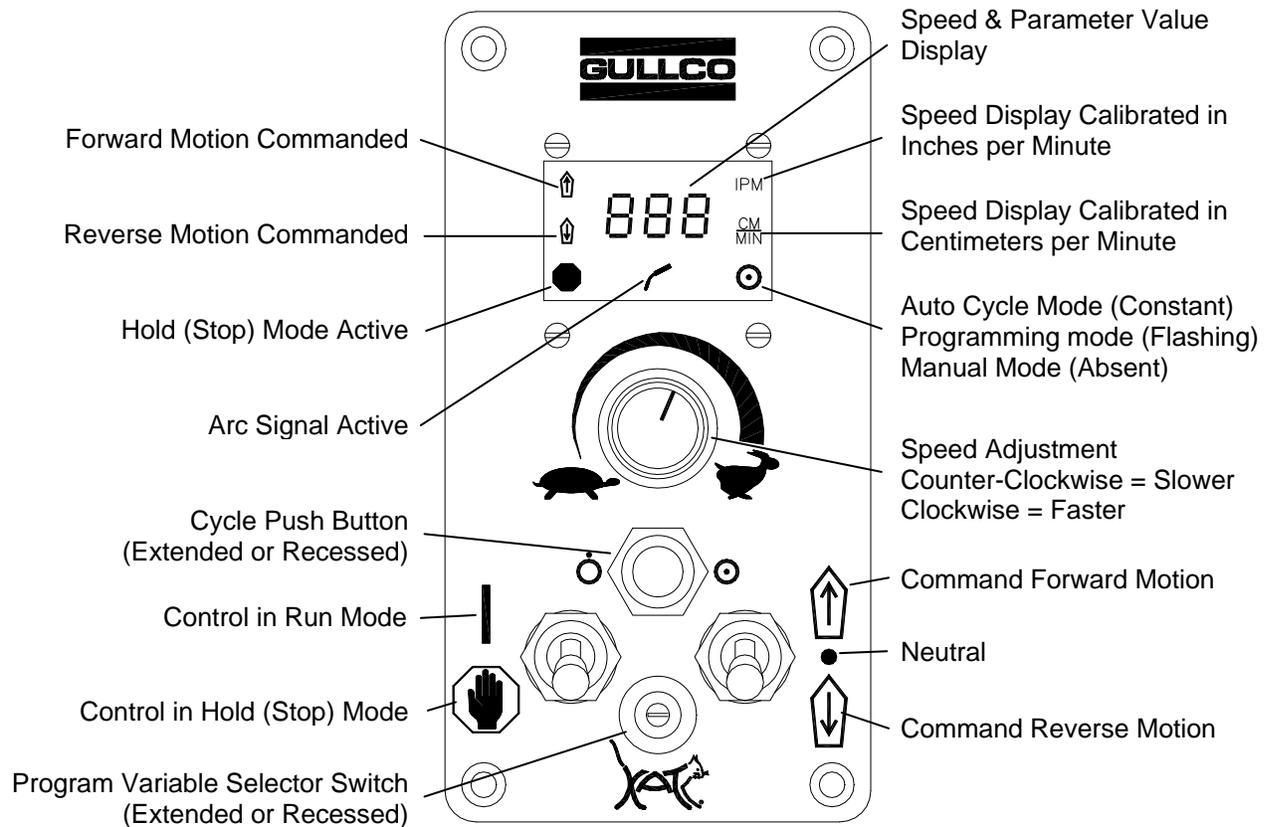
**WARNING!** The motor control must not be continually started and stopped by the removal and reapplying of power to the control. Turning the power off to the control will not provide instant braking and continued use will damage the control. Allow ten (10) seconds after the removal of power before reapplying the power to the motor control.

The fuse holder allows accessibility to the main fuse by pushing the cap in towards the main body and twisting in a counter-clockwise direction.



## GSP Control Overview

The following section provides operational details of the Gullco GSP-2001-10 microprocessor motor control used with the GM-02-250 SAM® portable friction drive travel carriages.



The following provides a brief description of the GSP controls (refer to the above sketch):

The Cycle Push Button – is a momentary device, which when pressed for one second while the Run/Stop switch is in the Stop position, will toggle between Manual Mode (Hnd) and Automatic Mode (Aut). When in Automatic Mode the Auto Cycle Mode LED will be illuminated. *The Cycle Push Button is also used to increment/decrement the values/settings of the program variables (refer to the section “Programming The Automatic Cycle Parameters/Variables” later in this manual for further details of this function).*

The Run/Stop Switch – is used to start and stop the “SAM” carriage in either Manual Mode or Automatic Mode. The Hold (Stop) position is also used to reset most error codes once they have been rectified.

The Forward/Neutral/Reverse Switch – is used to select the travel direction desired in both Manual Mode and Automatic Mode. *The Forward position is used to select increment, while the reverse position is used to select decrement as the method of changing the values/settings of the program variables (refer to the section “Programming The Automatic Cycle Parameters/Variables” later in this manual for further details of this function).*

The Speed Adjustment Knob - is used to increase (clockwise) or decrease (counter-clockwise) the travel speed of the carriage, both in Manual Mode and Automatic Mode. The carriage will travel at full speed during the no-weld part of a stitch cycle. The speed display will show the set speed when the Run/Stop switch is in the Stop position and the Forward/Neutral/Reverse switch is in the Neutral position.

The Program Variable Selector Switch – is a ten position rotary switch, used to set some of the values and settings which apply to the Automatic Cycle. This selector switch is an extended rotary switch. *Refer to the section “Programming The Automatic Cycle Parameters/Variables” later in this manual for further details of this selector switch.*

Please refer to the Technical Manual and its supplemental manual (GD-031) “Technical Information For The Gullco “GSP” Micro-Processor Based, 24 Volt DC Motor Control” (the pages are numbered with a prefix of “T-“), for additional, more comprehensive details than those provided in the following overview.

## **GSP CONTROL TECHNICAL INFORMATION**

The GSP-2010-10 microprocessor based motor control is a 24 vdc, full “H”-Bridge, pulse width modulation control with regenerative braking. Inside the chassis of the SAM<sup>®</sup> carriage is a power supply which converts the 42/115/230 VAC from the power source to a 30 to 38 vdc supply.

These controls can either operate with or without a closed loop tach feed back system attached to the armature of the motor. A tach feed back is normally recommended as it allows the motor control to constantly monitor and correct the speed of the motor providing accurate speed control regardless of any variance in loading. Open loop (i.e. no tach feed back) may be acceptable for manual motor operation in situations where; the motor sensor is awaiting replacement; the motor sensor is susceptible to failure due to an exceptionally harsh environment; or where accurate calibrated speed is not required and the loading of the motor is constant.

Various input and output ports are provided which are either optically coupled or transistor outputs. The ports that are applicable to this version of the control are described in detail later in this manual.

### **Important Notes:**

The motor control must not be continually started and stopped by the removal and reapplying of power to the control. Turning the power off to the control will not provide regenerative braking and continued use will damage the control.

Allow ten (10) seconds after the removal of power before reapplying the power to the "GSP" control.

The “Current Limit” (motor overload protection) on this product is typically factory preset to 8 Amps (unless specifically requested at time of order). If a specific application requires that this be

changed, please refer to the section which describes the “Motor Control Variables, Rotary Switch”, later in this manual.

The GSP-2004 microprocessor chip used in these controls is Electrostatic Discharge Sensitive. Suitable ESD precautions must be adhered to when handling the control and especially the microprocessor chip. Failure to comply may result in immediate or latent failure.

## GSP Error Codes

The "GSP" control has built in safety logic that reduces the risk of injury, damage and faulty operation. When the "GSP" control recognizes a potential problem, its LED's display an error code and the unit will not allow any motor output until the fault has been cleared and the control has been reset (placing the Forward/Neutral/Reverse switch in the Neutral position, or depending on the circumstances, powering down & waiting 10 seconds before powering back up). The Error Table on the following page lists the possible errors and their displayed error codes.

### Error Table

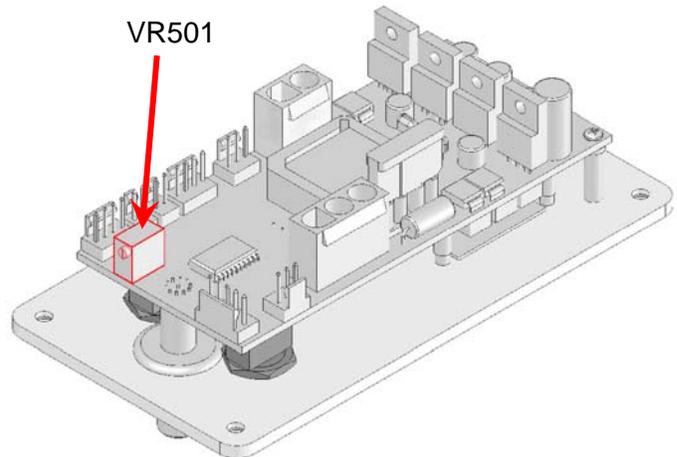
Error Code	Reason for Error
Er.1	The "GSP" control was set to run when; electrical power was initially supplied to the control (powered-up); or upon exiting either the Program Variable or Motor Control Variable settings. To prevent unexpected motion generated from the "GSP" control, the motor output is disabled and the error code displayed until the control is placed in "Neutral" to reset the error.
Er.2	Not applicable to this version of the control.
Er.3	The current draw of the motor exceeded the amperage set by the "Current Limit" variable of the "GSP" control. Rectify the fault causing the excessive current draw, or increase the value of the "Current Limit" variable - <b>only if it is set too low</b> . Then reset the "GSP" control by either powering-down the control, or by placing the Forward/Neutral/Reverse switch in the Neutral position to clear the error.
Er.4	As port "CN13" is usually used to interface normally closed travel limit switches, a closed circuit between pins 1 and 2 indicate a non-activated reverse travel limit switch and a closed circuit between pins 1 and 4 indicate a non-activated forward travel limit switch (a third limit switch is sometimes connected between pins 1 and 3). Each time the "GSP" control is powered-up, it checks the status of pins 2 & 4 of "CN13" with respect to pin 1 and if at least one is closed circuit, the control will continue to monitor their status (as well as the status of pin 3 where relevant) with respect to pin 1 (if both pins 2 & 4 were open circuit to pin 1 on power-up, the control ignores all signals for port "CN13"). Once the "GSP" control has recognized limit switches were connected to "CN13" but are no longer connected (i.e. pin 1 is no longer in a closed circuit with either pin 2 or 4), the motor output is disabled and the error code displayed. Rectifying the fault and resetting the "GSP" control by placing the Forward/Neutral/Reverse switch in the Neutral position will clear the error. <b>Note: turning the power to the "GSP" control off, waiting ten (10) seconds then re-applying the power will clear the error, but if the circuit remains open between pin 1 &amp; 2 as well as pin 1 &amp; 4, all signals coming into "CN13" will be ignored (failing to recognize limit switch signals).</b>
Er.5	Not applicable to this version of the control.
Er.6	When the GSP control recognizes that an encoder is connected, it expects to see encoder signals within two (2) seconds of energizing the motor output. If no encoder pulses are received within that time, the control will de-energize the motor output and display this error code. Rectifying the fault and resetting the "GSP" control by placing the Forward/Neutral/Reverse switch in the Neutral position will clear the error.

## **MOTOR CONTROL VARIABLE ADJUSTMENTS**

Motor Control Variables are adjustable parameters that affect the core operation of the motor control and its relationship with the motor. These variables are generic, regardless which product/application specific micro-processor chip is installed.

The Motor Control Variable Potentiometer is located on the underside of the control circuit board and is identified as VR501. A small flat-bladed screwdriver is required for adjustment.

Fully counter-clockwise is the normal operating location for this multi-turn potentiometer. When in any position other than fully counter-clockwise the control is in programming mode, the round, Preset Cycle L.E.D. in the bottom right hand corner of the display will flash and the motor control will not allow normal operation.



On the rare occasions that the Motor Control Variables require changing, it is usually necessary to remove the control assembly from the equipment to gain access to the underside of the circuit board and adjustments must be made with power applied to the control. Therefore, only competent and technically trained personnel should perform this procedure. Turn the power off to the equipment before removing the control assembly (by removing the four screws on the outer corners of the face plate). Once the control assembly has been removed from the equipment, position it to allow access to the front and back of the control. If it is necessary to disconnect any wiring from any of the circuit board connectors, take the time to identify their respective connectors (as some connectors are physically identical). The dc supply to the control must remain connected to "CN50".

To make changes to the Motor Control Variables, you must have access to the front and back of the control assembly. Only when safe to do so, turn on the power to the control. With the power turned on and the Auto-Enable/Manual Mode switch in the Manual Mode position, rotate the multi-turn Motor Control Variable Potentiometer (VR501) clockwise to the variable (parameter) to be altered (the Preset Cycle L.E.D. will flash on and off). The L.E.D. display on the front of the control will show the number of the parameter on the display when the Forward/Neutral/Reverse switch is in the Neutral position. I.e. "P. 1", "P. 2", "P. 3", etc. To see the current value/setting of the variable, place the Forward/Neutral/Reverse switch in either the Forward or Reverse position. To increment the value/setting, place the Forward/Neutral/Reverse switch in the Forward position and press the Cycle Push Button (located under the upper hole plug in the face plate). To decrement the value/setting, place the Forward/Neutral/Reverse switch in the Reverse position and press the Cycle Push Button. Pressing the Cycle Push Button briefly will increment/decrement the value/setting by one, whereas keeping the Cycle Push Button depressed will scroll through the values/settings until released. The speed display and or the individual L.E.D.'s will indicate the chosen value/setting. When all of the program variables are set, rotate the multi-turn Motor Control Variable Potentiometer fully counter-clockwise (the Preset Cycle L.E.D. will stop flashing). Turn the power off and re-install the control assembly.

The values/settings of the variables are stored on the product/application specific micro-processor chip. If the chip is replaced, the values/settings of the variables will need to be re-entered.

### **Descriptions of the Motor Control Variable parameter settings:**

The following describes the switch settings as rotated clockwise from zero (0).

- P. 0 Normal Operating Position - The control needs to be in this position to allow normal operation (top dead center).
- P. 1 Current Limit – This sets the maximum current draw that the motor control will allow before activating an error code and ceasing operation. The variable value range is from 00.0 to 15.0 Amps, in increments of 00.1 amperes.
- P. 2 Speed Calibration, 2 Most Significant Digits – This sets the first two digits of the maximum speed (regardless of decimal place). The variable value range is from 00 to 99, in increments of 1.
- P. 3 Speed Calibration, 2 Middle Digits – This sets the second two digits of the maximum speed (regardless of decimal place). The variable value range is from 00 to 99, in increments of 1.
- P. 4 Speed Calibration, 2 Least Significant Digits – This sets the last two digits of the maximum speed (regardless of decimal place). The variable value range is from 00 to 99, in increments of 01.
- P. 5 Speed Calibration, Decimal Place – This sets the decimal place location for the speed display. The variable settings range between no decimal places and two decimal places.
- P. 6 Calibration Units – This sets the units of calibration for the speed display. The variable settings offer either; inches per minute (Inc); or centimetres per minute (CEn); or non-specific (rAd). When the closed loop tach feedback is connected and; if the inches per minute option is selected the IPM L.E.D. will illuminate; or if the centimetres per minute option is selected the CM/MIN L.E.D. will illuminate; or if the non-specific option is selected neither the IPM nor the CM/MIN L.E.D.'s will illuminate.
- P. 7 Braking – This sets the level of motor braking from instant braking to a variable degree of pulsed graduated braking. The variable value range is from a reference value of 000 to 010 in increments of 1. A reference value of 0 provides instant braking whereas a reference value of 10 provides the slowest, softest pulse braking.
- P. 8 Response Gain – This sets the speed correction response rate. By having the motor speed correction rate at a slow response, the motor takes longer to accelerate to speed and reacts to motor speed variances slower. By having a fast response, the motor will accelerate to speed quickly, sometimes resulting in over shooting of the preset speed, and reacting to motor speed variances instantly, sometimes resulting in slight speed oscillation. The variable value range is from a reference value of 001 to 010 in increments of 1. A reference value of 1 provides the fastest speed correction rate, whereas a reference value of 10 provides the slowest, speed correction response rate.
- P. 9 Maximum Speed Scale – This sets the maximum speed at which the motor control will allow (the speed is capped at this set percentage). The variable value range is from 001 to 100 percent of full speed, in increments of 1%.

As a default the Motor Control Variables for the GSP-2010-10 will be factory pre-set as either one of the following:

Standard <b>Imperial</b> Settings for GM-02-250 SAM <sup>®</sup> Carriages									
Variable/Parameter	P. 1	P. 2	P. 3	P. 4	P. 5	P. 6	P. 7	P. 8	P. 9
Value/Setting	08.0	66	10	00	__ . _	Inc	001	002	100
Overall Result	The control will allow a current draw of up to 8 amperes. The speed will be calibrated so that full speed will display 66.1 IPM. The braking will be close to instantaneous. The speed correction response will be sharp. 100% of full speed will be available.								

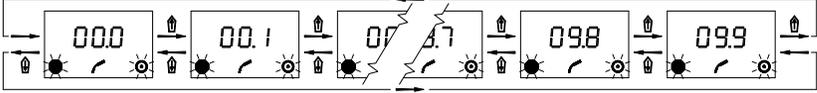
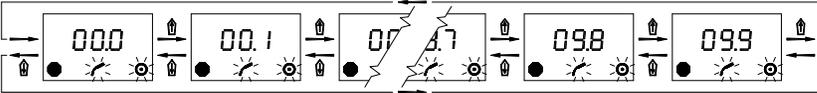
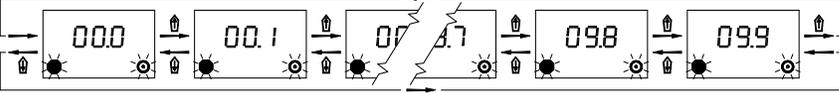
Standard <b>Metric</b> Settings for GM-02-250 SAM <sup>®</sup> Carriages									
Variable/Parameter	P. 1	P. 2	P. 3	P. 4	P. 5	P. 6	P. 7	P. 8	P. 9
Value/Setting	08.0	16	80	00	___ .	CM/MIN	001	002	100
Overall Result	The control will allow a current draw of up to 8 amperes. The speed will be calibrated so that full speed will display 168 CM/MIN. The braking will be close to instantaneous. The speed correction response will be sharp. 100% of full speed will be available.								

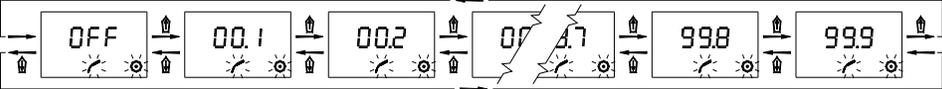
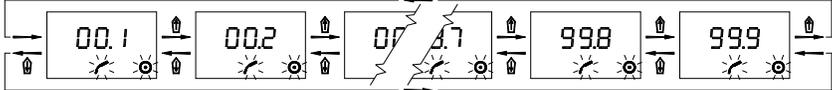
The Gullco “GSP” motor controller needs to have the speed display calibrated to match that of the equipment driven by the motor. This is required so that the speed displayed is equal to that of the motion. The speed calibration is performed with an accuracy of six (6) digits, however, on this specific version of the control only the first three (3) digits are required.

## Description of Programmable Parameters/Variables

### All Models

The following describes the Program Variable Selector Switch settings for the GSP motor control using Gullco's GSP-2004-10 micro-processor chip (GM-02-250), as rotated clockwise from zero (0) top dead centre.

Position	Details:
0	Normal Operating Position - The control needs to be in this position to allow normal operation of the unit (top-dead-centre).
P. 1	<p>Travel Motion Delay - Sets a delay after the activation of the Arc Signal Relay, prior to starting the weld travel, to allow for such things as shielding gas preflow and to allow the arc to establish before starting the welding/cutting motion. The variable value range is from 00.0 to 09.9 seconds, in increments of 00.1 seconds.</p> 
P. 2	<p>Crater Fill Delay - Sets a delay after the cessation of welding/cutting travel prior to de-energizing the Arc Signal Relay, allowing the welding/cutting signal to remain active after the motion has stopped. The variable value range is from 00.0 to 09.9 seconds, in increments of 00.1 seconds.</p> 
P. 3	<p>Post Weld Delay - Sets a delay after the Crater Fill Delay (above) prior to allowing the full-speed, no-weld motion to start. This is to allow the equipment to remain stationary over the end of the weld/cut for such things as burnback or postflow to occur. The variable value range is from 00.0 to 09.9 seconds, in increments of 00.1 seconds.</p> 

P. 4	<p>Stitch Weld - Enables/disables stitch welding and specifies length of each weld stitch. When OFF is selected the weld will be continuous. A numerical value specifies the distance in inches or cm (dependant upon the unit calibration of the control) that the carriage will travel during a stitch weld.</p> 
P. 5	<p>No-Weld Spacing - Specifies the distance in inches or cm (dependant upon the unit calibration of the control) that the carriage will travel between stitch welds. If the Stitch Weld parameter is set to "Off", then this parameter is disabled (forced to Off) and the display variable will show "- - -".</p> 

### **Factory Settings:**

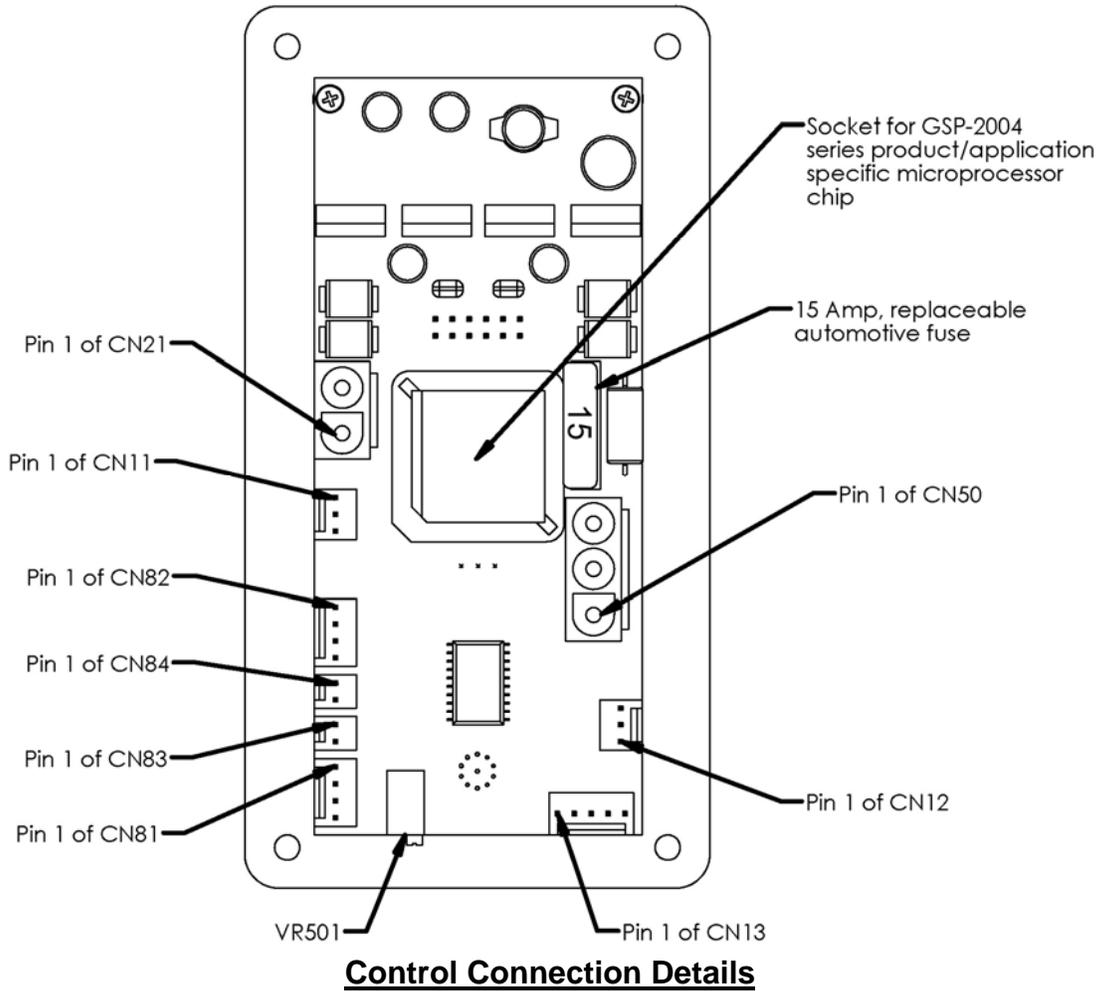
The following table shows the settings/values of the Programmable Parameter/Variables as supplied from the factory:

Switch Position	Parameter	GM-02-250 (GSP-2004-10) Value
P. 1	Travel Motion Delay	00.3 (seconds)
P. 2	Crater Fill Delay	00.5 (seconds)
P. 3	Post Weld Delay	01.0 (seconds)
P. 4	Stitch Weld Selection	Off
P. 5	No-Weld Spacing	- - -
P. 6	Not Applicable	- - -
P. 7	Not Applicable	- - -
P. 8	Not Applicable	- - -
P. 9	Not Applicable	- - -

The standard equipment and functionality as described in this manual is suitable for a large percentage of simple welding and cutting procedures, however, Gullco has many different product/application modules, attachments and programs to accommodate more complex applications requiring features above those provided here. Please consult your local Gullco dealer to discuss your specific application.

## GSP CIRCUIT BOARD DETAILS

### "GSP" CIRCUIT BOARD DETAILS



**Note: CN50 & CN21 are Molex 0.093" [2.36mm] series connectors**

#### CN50 - Power Supply Input

- Pin 1 - Optional earth ground
- Pin 2 - common
- Pin 3 - 24 to 38 Vdc supply

#### **Note:**

Pin 1 is not required when control faceplate is secured to a conductive, earthed plane.

#### CN21 - Motor Output

- Pin 1 - Motor output
- Pin 2 - Motor output

#### **Note:**

Pins 1 and 2 may be swapped to reverse polarity (only necessary to match the forward and reverse of the motor with those of the control).

**Note: CN11 to CN13 & CN81 to CN84 are Molex KK, 0.1" [2.54mm] series connectors, or equivalent spaced headers**

CN11 - Tach Feed Back Connection

Pin 1 - Common  
Pin 2 - Signal  
Pin 3 - Sensor detection and current source

**Note: Because the following connectors are effectively inputs/outputs, the particular program of the product/application specific micro-processor chip installed may use these ports for specific signals, other than their common use (described below).**

CN12 - Auxiliary "Hold" (Stop) Port (Typical)

Pin 1 - Common  
Pin 2 – "Hold" (Stop) (digital input active LOW)  
Pin 3 – Port active recognition

Note:

When the "GSP" control is initially powered-up, it looks to see if pins 1 & 3 are in a closed circuit, thereby indicating a device/signal using this port. If the control does not see pin 3 connected to common, it assumes that nothing is connected to this port and will not look for the auxiliary "Hold" (stop) signal. **Therefore, any auxiliary "Hold" (stop) device that is connected to the control after it has been powered-up will be ignored.** After the microprocessor has recognised that a device is connected to this port, it will activate the "Hold" (stop) command when pin 1 & 2 are in a closed circuit.

CN13 - Limit Switch Monitoring Input (Typical)

Pin 1 - Common  
Pin 2 - Reverse limit switch  
Pin 3 - Center limit switch  
Pin 4 - Forward limit switch  
Pin 5 - Spare (not used)

Note:

Limit switches are to be wired in the "normally closed" configuration to allow normal use. When the "GSP" control is initially powered-up, it looks to see if either the forward or reverse limit switches are in closed circuit to common. If the control does not see either of pins 2 or 4 connected to common, it assumes that no limit switches are in use and will not look for further signals. **Therefore limit switches that are connected to the control after it has been powered-up will be ignored.** After the microprocessor has recognised that limit switches are being used, it will disable any travel in the relevant direction to that of an open circuit.

## Logic Output Ports

### CN81 - Relay Drive Output (Transistor Output)

Pin 1 - Common  
Pin 2 - Spare (not used)  
Pin 3 - Transistor collector out  
Pin 4 - +12 V

#### Note:

This port is typically configured to activate whenever the arc signal is called for in the automatic cycle routine.

Pin 3 and Pin 4 are typically used to energize the coil of the optional auxiliary relay module, which is usually connected to the welding/cutting trigger signal.

### CN83 - Optically Coupled Output Signal

Pin 1 - Emitter  
Pin 2 - Collector

#### Note:

This port is typically configured to activate whenever the arc signal is called for in the automatic cycle routine (activated at the same time as CN81, providing an optically coupled output signal as an alternative to a transistorized output).

### CN82 - Relay Drive Output (Transistor Output)

Pin 1 - Common  
Pin 2 - Spare (not used)  
Pin 3 - Transistor collector out  
Pin 4 - +12 V

#### Note:

Depending upon the product/application specific micro-processor chip installed, this port, in conjunction with one of Gullco's optional auxiliary relay modules, may be used to activate such things as pneumatic solenoid valves, safety circuits, etc. that may be part of the automatic cycle routine.

Pin 3 and Pin 4 are typically used to energize the coil of an optional auxiliary relay module.

### CN84 - Optically Coupled Output Signal

Pin 1 - Emitter  
Pin 2 - Collector

#### Note:

This port is typically configured to activate at the same time as CN82, providing an optically coupled output signal as an alternative to a transistorized output.

### **Caution:**

*Even though this control and its input and output ports have been designed to be as non destructible and as isolated and durable as possible, extreme radiated high frequency bombardment **may** cause a malfunction of the control. Gullco recommends that they be consulted in such instances.*

## **MAINTENANCE**

The Gullco heavy duty SAM<sup>®</sup> carriage is a robust piece of equipment and, under normal conditions, it will provide years of trouble free service, if it is operated within the limits of its expected use and if the following maintenance points are adhered to:

Clean all excess dust and spatter from the carriage and any mounting brackets regularly. Pay particular attention to the drive wheels and the guide wheel assemblies of the SAM<sup>®</sup> carriage.

## **INSPECTION**

Frequent inspections should be performed with respect to the stability and rigidity of the wire feed head mounting brackets and slides.

The guide wheels should be checked for smooth rotation.

The integrity of the rubber wheels should be checked and replaced as necessary.

Check for smooth and proper operation of the foot clutch.

Inspect the condition of the drive chains in the SAM<sup>®</sup> carriage chassis. Apply non-drip lubrication as needed.

It is recommended that once per year, the equipment should be taken out of service, stripped down and all moving parts should be cleaned, greased and inspected for wear and damage. All cables must be inspected for breaks and abrasions and must be well secured. All damaged and worn parts should be replaced with Gullco genuine/authorized parts. All fastening devices should be inspected for tightness.

**NOTE:** These inspections should be performed with greater frequency if conditions and usage require.

## **HANDLING**

The SAM<sup>®</sup> carriage, by design, is a portable piece of equipment. I.e. after it performs a welding pass, it is hoisted or wheeled to the start of the next pass. However, because of its portability the SAM<sup>®</sup> carriage is susceptible to damage, therefore, care should be taken to avoid dropping or impacting the unit.

Keep handles & lifting points dry, clean, free from oil & grease and in good repair

Do not lift this machine if equipped with heavy accessories or welding cables attached.

Lift machine only with equipment of adequate lifting capacity and never lift or suspend the machine over people.

## **STORAGE**

The SAM® carriage should be kept in a dry environment with no possibility of impact or damage due to stacking of heavy objects on top of the equipment.

It is recommended to apply non-drip lubrication to the drive chains, axle bearings and clutch mechanisms before storing for long periods.

For storage periods of over 60 days, all machined surfaces should be protected with a suitable anti-oxidization product.

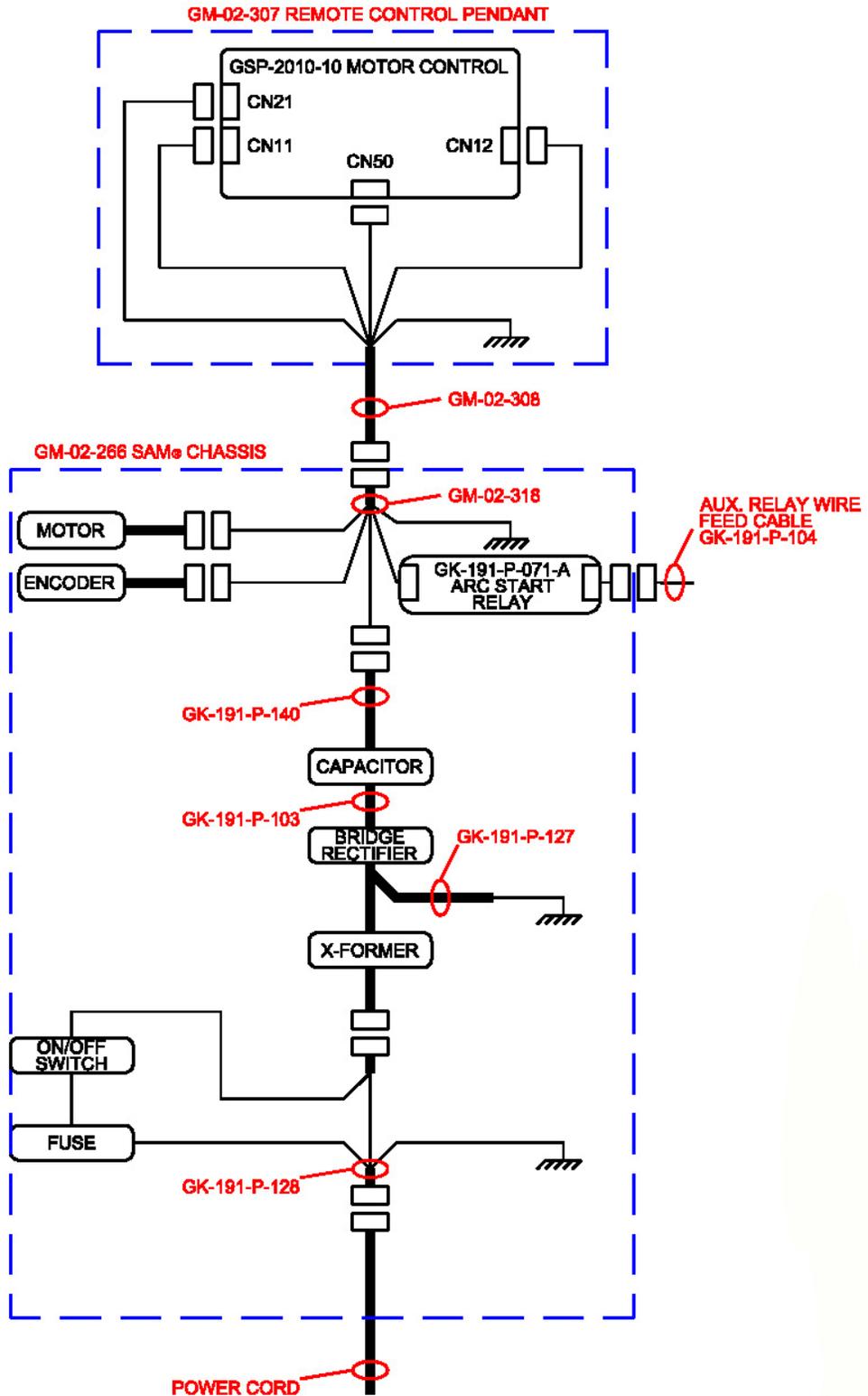
When the equipment is brought out of storage, always thoroughly inspect the condition of the machine prior to use.

## **SHIPPING**

When shipping the SAM® carriage, it is recommended that all the quick disconnect assemblies and the guide roller assemblies be removed from the unit and packed separately. Adequate packing material must be placed around the chassis to protect the SAM® carriage chassis and axles from damage during transportation.

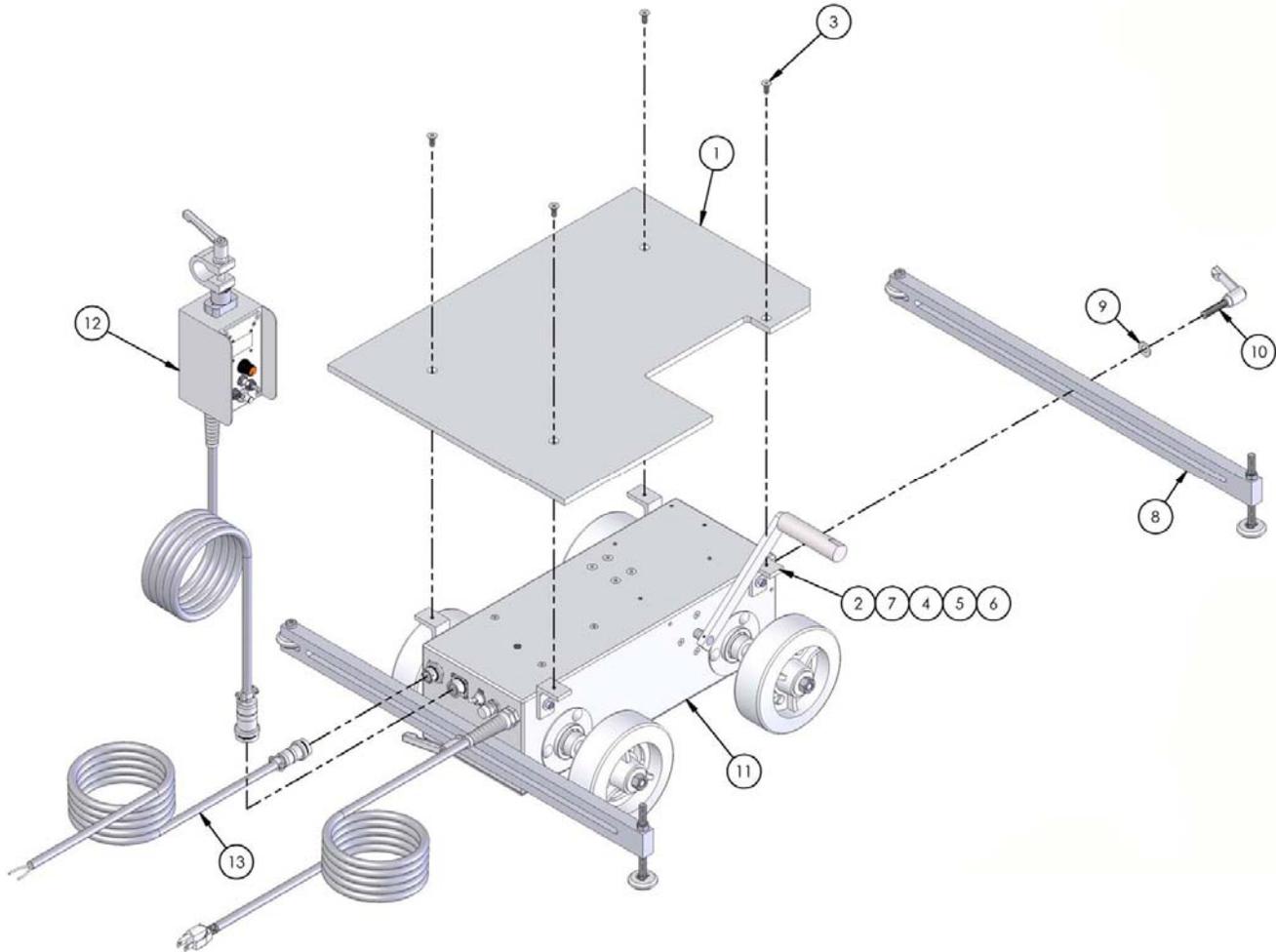
# BLOCK WIRING DIAGRAM OF A GULLCO SAM® CARRIAGE

Drawing Number GM-02-149

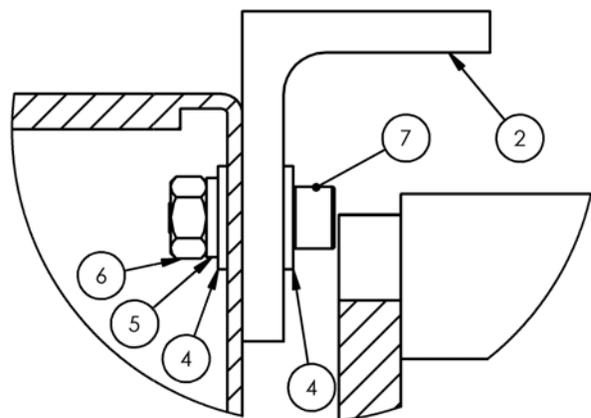


# SAM® CARRIAGE PARTS BREAKDOWN

Drawing Number GM-02-250



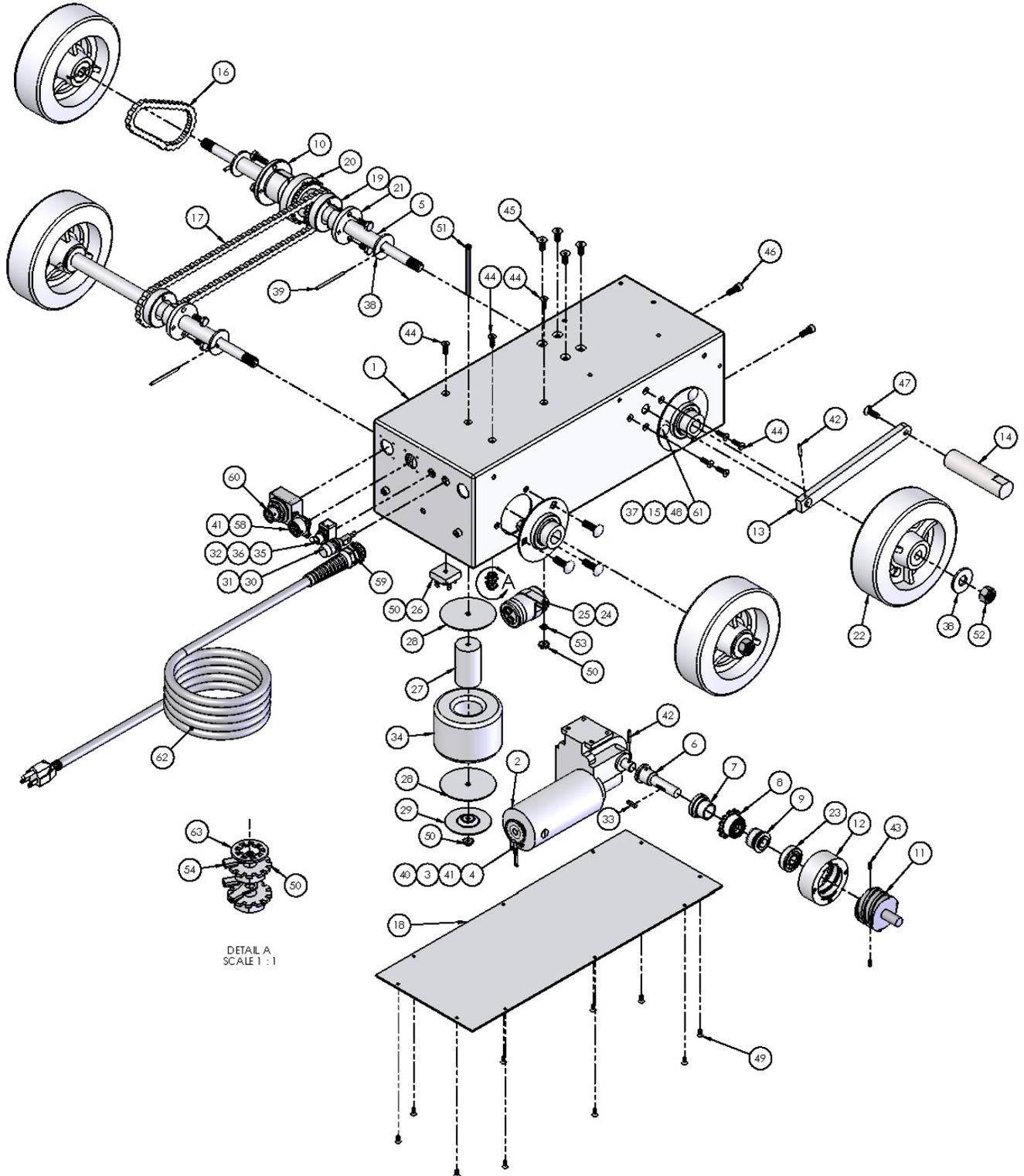
ITEM	PART NO.	DESCRIPTION	QTY.
1	GM-02-254	MOUNTING PLATE	1
2	GM-02-252	MOUNTING BRACKET	4
3	GK-105-074	1/4-20UNC x 5/8 FHSCS	4
4	GK-111-051	WASHER 1/4 BOLT X 5/8 OD X 0.057	8
5	GK-136-053	LOCK WASHER 1/4 BOLT	4
6	GK-109-050	1/4-20UNC HEX NUT	4
7	GK-107-054	1/4-20UNC x 3/4 SHCS	4
8	GM-02-082	GUIDE ARM ASSEMBLY	2
9	GK-111-058	WASHER 3/8 BOLT x 13/16 OD x 1/16	2
10	GK-153-005	3/8-16 x 1-9/16 ADJUSTABLE HANDLE	2
11	GM-02-266	LOWER HOUSING ASSEMBLY	1
12	GM-02-307	REMOTE CONTROL PENDANT	1
13	GK-191-P-104	AUX. RELAY WIRE FEED CABLE	1



MOUNTING BRACKET  
ASSEMBLY VIEW

# SAM® LOWER HOUSING (CHASSIS) PARTS BREAKDOWN

Drawing Number GM-02-266



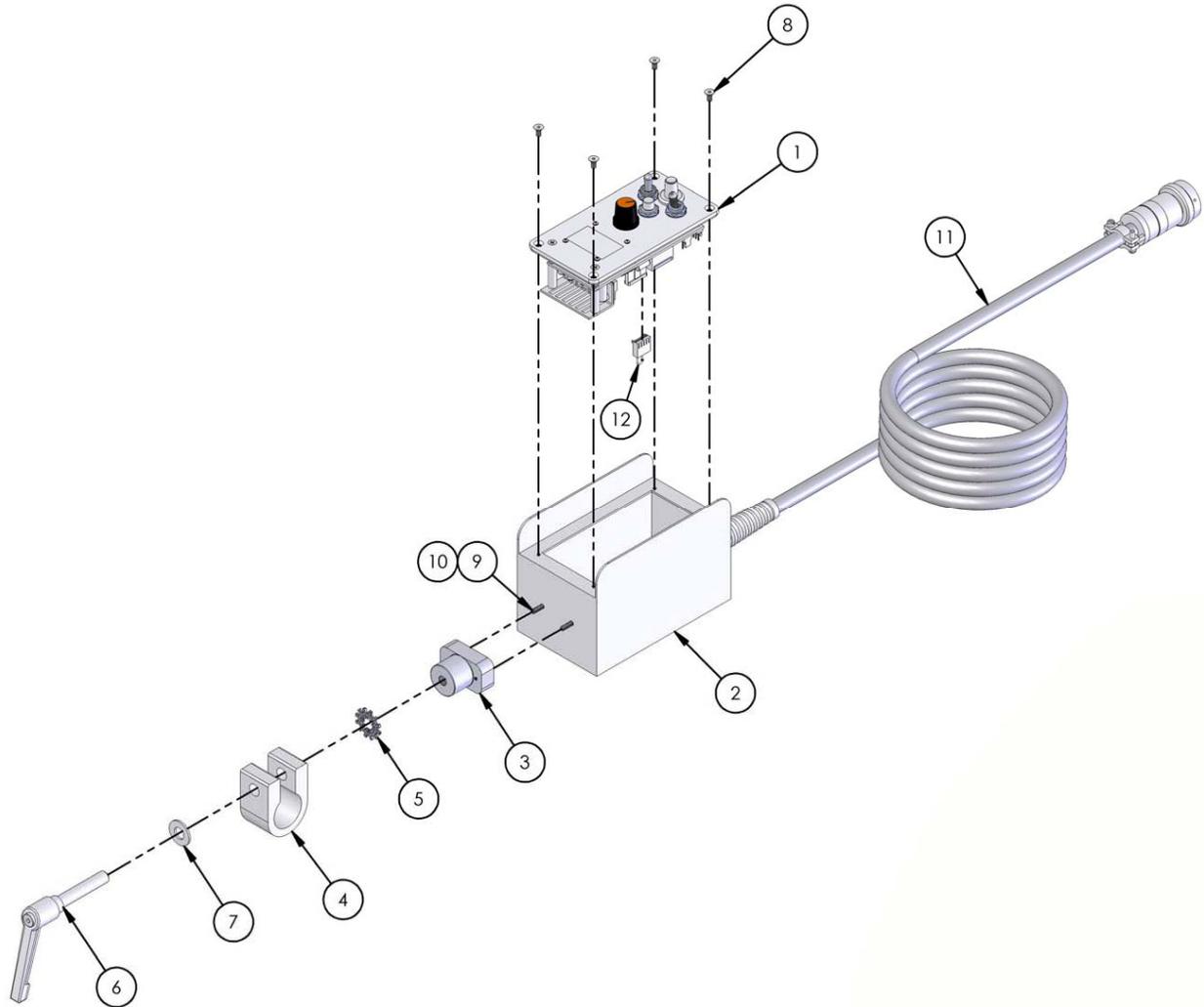
# SAM® LOWER HOUSING (CHASSIS) PARTS BREAKDOWN

## Drawing Number GM-02-266

ITEM	PART NO.	DESCRIPTION	QTY.
1	GM-02-278	MAIN CHASIS	1
2	GM-02-116	24VDC MOTOR & 1080:1 GEARBOX	1
3	GK-191-P-038	ENCODER DISC	1
4	GK-191-P-035	ENCODER SENSOR, INCLUDING WIRING & CONNECTOR	1
5	GM-02-289	WHEEL AXLE	2
6	GM-02-114	MOTOR EXTENSION SHAFT	1
7	GM-02-267	FLANGED BUSHING	1
8	GM-02-281	12 TOOTH CHAIN SPROCKET/ 22 TOOTH CLUTCH JAW	1
9	GM-02-112	22 TOOTH CLUTCH JAW	1
10	GM-02-283-B	TAPERED BUSHING H/3/4	1
11	GM-02-111	CLUTCH ACTUATOR	1
12	GM-02-110	CLUTCH NUT	1
13	GM-02-075	FOOT PEDAL ARM	1
14	GM-02-330	FOOT PEDAL FOR PLATFORM	1
15	GM-02-004	FLANGETTE BEARING RA012RRB+COL	4
16	GM-02-291	DRIVE CHAIN	1
17	GM-02-292	DRIVEN CHAIN	1
18	GM-02-014	BASE PLATE	1
19	GM-02-282A	16 TOOTH CHAIN SPROCKET 36H19	2
20	GM-02-283A	19 TOOTH CHAIN SPROCKET 35H19	1
21	GM-02-282-B	TAPERED BUSHING G-3/4	2
22	GM-02-286	DRIVE WHEEL	4
23	GM-02-115	1/2" BORE ANGULAR CONTACT BEARING LJ11/2MB	1
24	GK-191-P-062	CAPACITOR	1
25	GK-191-P-063	CAPACITOR CLIP	1
26	GK-191-P-020	BRIDGE RECTIFIER	1
27	GM-02-257	TRANSFORMER SPACER	1
28	GK-191-P-218	TRANSFORMER MOUNTING PAD	2
29	GK-191-P-105	TRANSFORMER MOUNTING PLATE	1
30	GK-165-134	FUSE HOLDER ASSEMBLY	1
31	GK-165-097	1.25AMP FUSE	1
	GK-165-099	2.5 AMP FUSE	
	GK-165-098	5 AMP FUSE	
32	GK-191-P-050	ON/OFF NAME PLATE	1
33	GM-02-117	1/8" SQUARE KEY	1
34	GK-191-P-019-A	TRANSFORMER 42V	1
	GK-191-P-019-B	TRANSFORMER 115V	
	GK-191-P-019-C	TRANSFORMER 230V	
35	GK-191-P-022	POWER ON/OFF SWITCH	1
36	GK-191-P-056	ON/OFF SWITCH NUT	1
37	GK-160-004	5/16-18UNC x 1 CARRIAGE BOLT	12
38	GK-111-084	WASHER 9/16 ID x 1-3/8 OD x 0.109	8
39	GK-117-021	1/8 x 2 SPRING PIN	4
40	GK-106-063	#4-40UNC x 3/16 SET SCREW	3
41	GK-112-060	#4-40UNC x 1/4 RND HEAD SCREW	6
42	GK-117-008	1/8 x 3/4 SPRING PIN	2
43	GK-106-056	#6-32UNC x 3/8 SET SCREW	2
44	GK-105-063	#10-32UNF x 5/8 FHSCS	7
45	GK-105-074	1/4-20UNC x 5/8 FHSCS	4
46	GK-107-062	1/4-20UNC x 5/8 SHCS	4
47	GK-105-055	1/4-20UNC x 3/4 FHSCS	1
48	GK-109-052	5/16-18UNC HEX NUT	12
49	GK-105-052	#6-32UNC x 3/8 FHSCS	10
50	GK-135-057	#10-32 LOCK NUT	5
51	GK-141-019	#10-32UNF x 3 FHMS	1
52	GK-109-059	1/2-13UNC HEX NUT	4
53	GK-111-068	WASHER #10 BOLT x 3/8 OD x 0.050	1
54	GK-156-010	GROUND LUG	3
55	GK-191-P-103	DISCHARGE RESISTOR WIRING HARNESS(NOT SHOWN ON DRAWING)	1
56	GK-191-P-127	HF CAPACITOR WIRING HARNESS(NOT SHOWN ON DRAWING)	1
57	GK-191-P-128	LINE CORD INTERFACE WIRING HARNESS(NOT SHOWN ON DRAWING)	1
58	GM-02-318	REMOTE CONNECTOR ASSEMBLY	1
59	GK-148-015	PIGTAIL STRAIN RELIEF	1
60	GK-191-P-071-A	ARC START RELAY ASSEMBLY	1
61	GK-136-055	LOCK WASHER 5/16 BOLT	12
62	GK-171-032	POWER CORD	1
63	GK-129-002	1/4 INTERNAL STAR WASHER	1

## REMOTE CONTROL PENDANT PARTS BREAKDOWN

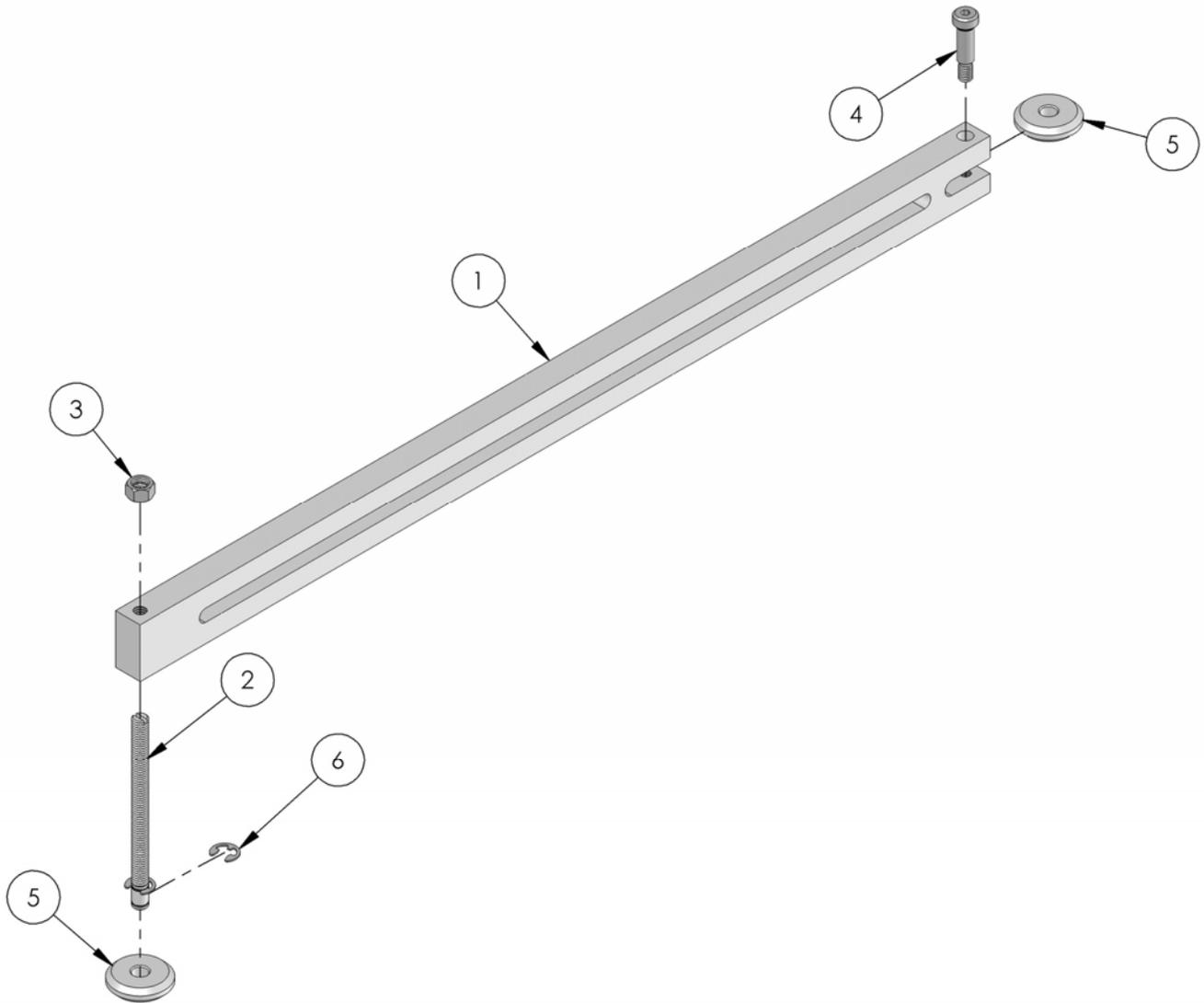
Drawing Number GM-02-307



ITEM	PART NO.	DESCRIPTION	QTY.
1	GSP-2010-10	GSP-2010 MOTOR CONTROL	1
2	GP-200-013	REMOTE PENDANT ENCLOSURE	1
3	GK-190-161	SWIVEL MOUNTING BRACKET	1
4	GK-166-183	1-1/8 SWIVEL CLAMP	1
5	GK-129-007	3/8 COMBINATION STAR WASHER	1
6	GK-153-014	3/8-16UNC x 2.48" ADJUSTABLE HAND LEVER	1
7	GK-111-058	WASHER 3/8 BOLT x 13/16 OD x 1/16	1
8	GK-141-014	#6-32UNC x 5/16 FLAT HEAD MACHINE SCREW	4
9	GK-112-051	#6-32UNC x 1/2 RND HEAD SCREW	2
10	GK-111-059	WASHER #6 BOLT x 5/16 OD x 0.033	2
11	GM-02-263	GSP 2000 SERIES REMOTE PENDANT CABLE ASSY.	1
12	GM-02-309	CONTROL JUMPER	1

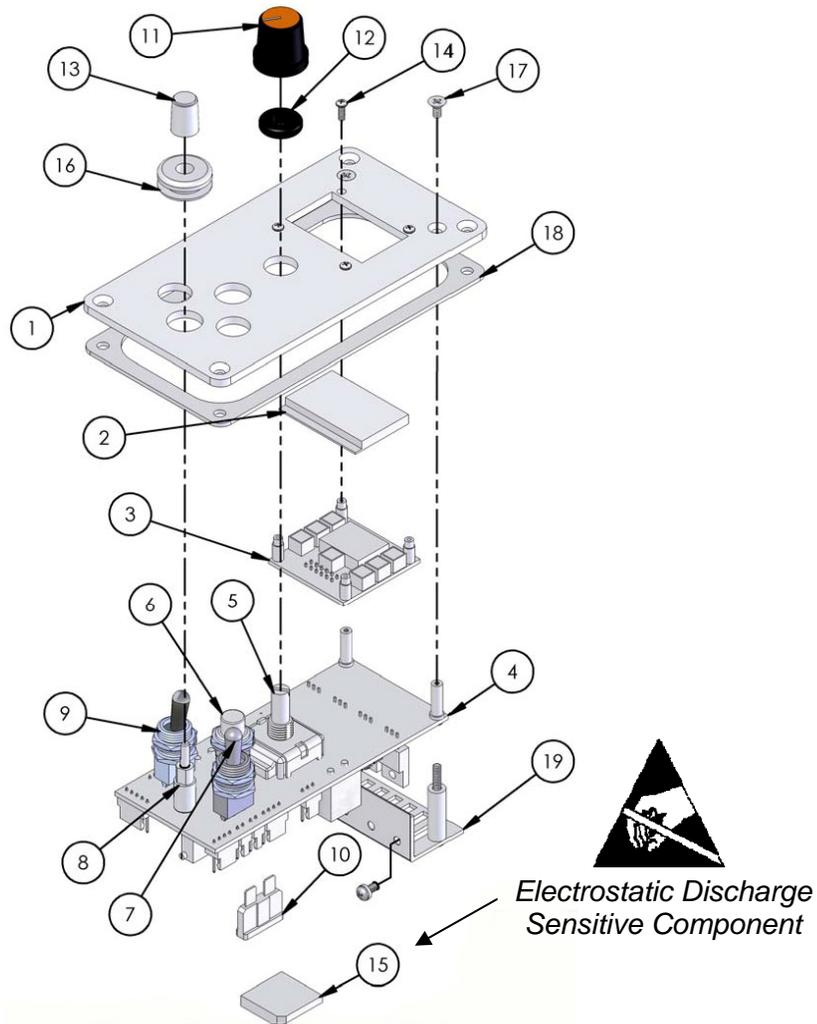
## GUIDE ARM ASSEMBLY PARTS BREAKDOWN

Drawing Number GM-02-082



ITEM	PART NO.	DESCRIPTION	QTY.
1	GM-02-012	GUIDE ROLLER ARM	1
2	GM-01-066	ADJUSTABLE GUIDE ROLLER BOLT	1
3	GK-110-061	3/8-16UNC HEX HEAD JAM NUT	1
4	GK-104-073	3/8 x 1 SHOULDER BOLT	1
5	GM-01-029-C	COPPER GUIDE WHEEL	2
6	GK-119-059	3/8 SHAFT EXTERNAL RETAINING RING	2

## GSP-2010-10 CONTROL ASSEMBLY PARTS BREAKDOWN

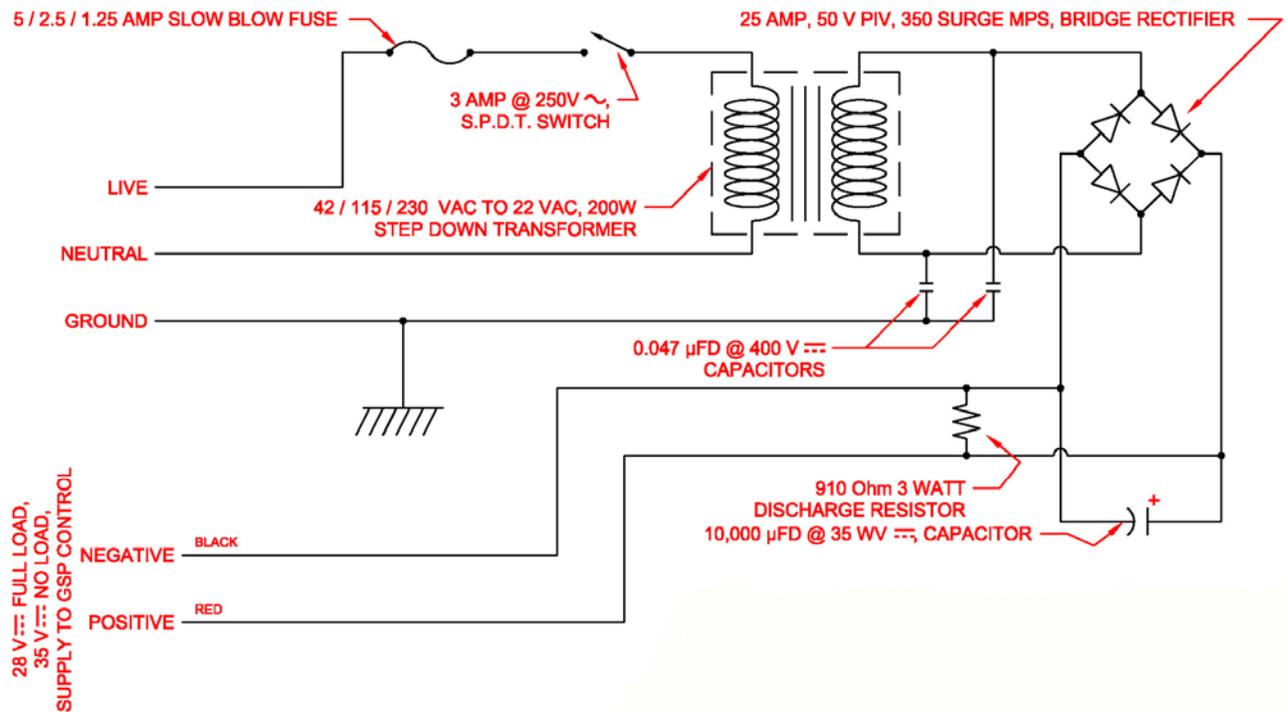


ITEM	PART NO.	DESCRIPTION	QTY.
1	GSP-2005	GSP CONTROL FACEPLATE	1
2	GK-191-P-223	DISPLAY BEZEL	1
3	GSP-2003	GSP DISPLAY BOARD	1
4	GSP-2018	GSP MAIN BOARD ( INCLUDES ITEMS 5-9)	1
5	GK-191-P-235	ROTARY SPEED ENCODER	1
6	GK-191-P-236	CYCLE PUSH BUTTON (EXTENDED)	1
7	GSP-2007	FORWARD/NEUTRAL/REVERSE SWITCH	1
8	GSP-2012	PROGRAM VARIABLE SELECTOR SWITCH (EXTENDED)	1
9	GSP-2008	RUN/STOP SWITCH	1
10	GSP-2006	15 AMP FUSE	1
11	GK-191-P-097	SPEED SELECTOR KNOB	1
12	GK-151-004	GROMMET	1
13	GK-194-O-023	SMALL SELECTOR KNOB	1
14	GK-112-091	#2-56 x 1/4" PAN HEAD SCREW	4
15	GSP-2004-10	MICRO-PROCESSOR CHIP	1
16	GK-151-005	SELECTOR KNOB GROMMET	1
17	GK-141-013	#4-40 x 1/4" FHMS	2
18	GSP-2027	GSP FACEPLATE GASKET	1
19	GSP-2024	GSP HEAT SINK	1



# SAM® CARRIAGE POWER SUPPLY WIRING DIAGRAM

Drawing Number GM-02-162



## **REVISIONS LIST**

Sept, 2010

Overall

Creation of manual.

### **ADDITIONAL NOTES**

Specifications and products are subject to change without notice.

KAT, Moggy, Sam, KATBAK & KBM are registered trademarks of Gullco International Enterprises Ltd.

Only use genuine/authorized replacement parts.





**GULLCO**



LINEAR or RADIAL  
HIGH DEPOSIT RATE  
QUICK SETUP TIME

## KAT® OSCILLATOR

- Motorized weld center line adjustment
- Motorized stroke width
- Oscillation speed control
- Store up to 10 welding programs



PORTABLE PLATE EDGE  
BEVELLING MACHINE  
QUICK SETUP TIME

## KBM®

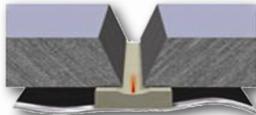
- Produce clean bevels with no thermal distortion
- Bevels angles 22° to 55° (other angles available)
- Hydraulic and Adjustable undercarriages available
- Bevels Mild Steel, Stainless Steel, and Aluminium
- Reduce cost and save time by minimising defects and poor fit up



ONE SIDED WELDING  
X-RAY QUALITY BEADS  
HIGH DEPOSIT RATE

## KATBAK® CERAMIC WELD BACKING

- Eliminate Defects And Rework
- Eliminate Costly Unnecessary Gouging And Grinding
- Sizes 1/4" (6.3 mm) to 2" (51 mm)
- Special Sizes And Configurations Available



PORTABLE AND COMPACT  
INCREASE EFFICIENCY  
MORE ARC ON TIME

## MOGGY® FILLET WELD CARRIAGE

- Single or Dual Torch Models
- Magnet or Non Magnetic Base
- Continuous or Stitch Welding Models
- Fillet, Lap, Butt and Dual Torch Welding

