

Word Form

The directions referred to are based on the front view point of the machine.

Take-Up Spool - The take-up spool is responsible for holding the spent wire after it comes off of the machine. It will accelerate at the same rate as the pair of guide rollers and will maintain the same speed as the guide rollers. This will be done through the use of motors with encoders to tell the system the speed, location, and direction of the take-up spool. Any velocity mismatch between the guide rollers and the take-up spool will be dealt with by the left dancer pulley until the machine has time to adjust the spool speed.

Feed Spool -The feed spool is responsible for holding the unused wire before it goes through the machine. It will accelerate at the same rate as the pair of guide rollers and will maintain the same speed as the guide rollers. This will be done through the use of motors with encoders to tell the system the speed, location, and direction of the feed spool. Any velocity mismatch between the guide rollers and the take-up spool will be dealt with by the right dancer pulley until the machine has time to adjust the spool speed.

Left Guide Roller - The left guide roller is responsible for working with the right guide roller to accelerate the wire and hold it at a constant velocity. The left guide roller needs to match angular velocity and acceleration of the virtual axis. The left guide roller will be powered by a motor with an encoder, to monitor the velocity and location of the motor. The encoder will communicate with the PLC to compare the angular velocities of the left guide rollers to the virtual axis and adjust the motor outputs accordingly to meet the desired angular velocity.

Right Guide Roller - The right guide roller is responsible for working with the left guide roller to accelerate the wire and hold it at a constant velocity. The right guide roller needs to match angular velocity and acceleration of the virtual axis. The right guide roller will be powered by a motor with an encoder, to monitor the velocity and location of the motor. The encoder will communicate with the PLC to compare the angular velocities of the right guide rollers to the virtual axis and adjust the motor outputs accordingly to meet the desired angular velocity.

Left Dancer Pulley -The left dancer pulley is responsible for adjusting the wire path between the take-up spool and the left guide roller. The wire path is adjusted to account for the velocity mismatch between the left guide roller and the take-up spool. The dancer pulley location and rate of change of location will be monitored by a position sensor which will communicate with the PLC and respond to the position according to the following rules. When the machine is indexing wire in the forward direction the left dancer pulley moves towards the back of the machine when the left guide roller is moving faster than the take-up spool. The left dancer pulley move towards the front of the machine when the left guide roller is moving slower than the take-up spool. When the machine is indexing in the reverse direction the left dancer pulley moves towards the front of the machine when the left guide roller is moving faster than the take-up spool. The left dancer pulley move towards the back of the machine when the left guide roller is moving slower than the take-up spool

Right Dancer Pulley - The right dancer pulley is responsible for adjusting the wire path between the feed spool and the right guide roller. The wire path is adjusted to account for the velocity mismatch between the right guide roller and the feed spool. The dancer pulley location and rate of change of location will be monitored by a position sensor which will communicate with the PLC and respond to the position according to the following rules. When the machine is indexing wire in the forward direction the right dancer pulley moves towards the front of the machine when the right guide roller is moving faster than the take-up spool. The right dancer pulley move towards the back of the machine when the right guide roller is moving slower than the feed spool. When the machine is indexing in the reverse direction the right dancer pulley moves towards the back of the machine when the right guide roller is moving faster than the take-up spool. The right dancer pulley move towards the front of the machine when the right guide roller is moving slower than the feed spool.

Take-Up spool Transverse pulley - The take-up spool indexing pulley is responsible for evenly distributing wire on the take-up spool as the machine runs. The take-up spool indexing pulley will move forward and backwards on the machine over the traverse length of the spool at a rate that is proportional to the angular velocity of the take-up spool. The pulley will be attached to a lever arm that is perfectly balanced. The pulley will move in the upward direction as the take-up spool outer diameter increases in order to keep the wire perpendicular to the take-up spool outer diameter. The pulley will move in the downward direction as the take-up spool outer diameter decreases in order to keep the wire perpendicular to the take-up spool outer diameter.

Feed spool Transverse pulley - The feed spool indexing pulley is responsible for evenly distributing wire on the feed spool as the machine runs. The feed spool indexing pulley will move forward and backwards on the machine over the traverse length of the take-up spool at a rate that is proportional to the angular velocity of the feed spool. The pulley will be attached to a lever arm that is perfectly balanced. The pulley will move in the upward direction as the feed spool outer diameter increases in order to keep the wire perpendicular to the feed spool outer diameter. The pulley will move in the downward direction as the feed spool outer diameter decreases in order to keep the wire perpendicular to the feed spool outer diameter.

Dovetail - The dovetail is responsible for allowing the work piece to be secured to the fixture mount. The workpiece is glued to a sacrificial piece of glass which is then glued to the work piece fixture. The dovetail determines the x and y orientation of the workpiece depending on how it is oriented and glued together.

Fixture mount - The dovetail mount is responsible for holding the work piece fixture in the correct x, y, and z location. The dovetail mount is the opposite outline of the work piece fixture to allow the two to slide together. The fixture mount uses an actuator mounted bolt to hold the work piece fixture into the mount.

Feed side Inline Spool - The inline spool is responsible for monitoring the speed of the wire as it comes off of the feed spool. It connects to a feed side guide pulley and calculates the speed of

the wire based on the angular velocity of the guide pulley. The velocity is communicated to the PLC and used to adjust the spools velocity in order to maintain a constant wire velocity.

Take-up side Inline Spool - The inline spool is responsible for monitoring the speed of the wire as it comes off of the take-up spool. It connects to a feed side guide pulley and calculates the speed of the wire based on the angular velocity of the guide pulley. The velocity is communicated to the PLC and used to adjust the spools velocity in order to maintain a constant wire velocity.

Slurry system - The slurry system is responsible for applying slurry to the wire cutting planes where the wire makes contact with the work piece. The slurry system is also responsible for gathering up the used slurry so that it can be recirculated through the system. The slurry system will also need to filter the slurry before it is recirculated through the system.

Door Safety latches - The safety latches are responsible for ensuring that all doors are closed on the machine before the machine enters run mode. The latches will complete a connection which signals to the PLC that the machine is in a safe state to start operation. If a door is not closed and a safety latch is not completing the connection then the machine will not start and provide an error message specifying why. If a latch is switched during machine operation, then the PLC will be triggered to initiate an emergency stop and an error message will display.

Frame - The frame is responsible for holding each component in its specified location relative to all other components. The frame is also responsible for being able to withstand heat and vibrations produced by the components without any deformation. The frame needs to be sturdy enough and light to move the machine.

Control panel - The control panel is responsible for taking user inputs and implementing them across the rest of the machine. The control panel is the main user interface between the operator and the machine. The control panel is also responsible for displaying error messages communicated to it by the PLC.

Component	Dependencies
Take-up Spool	Left Dancer Pulley, PLC
Feed Spool	Right Dancer Pulley, PLC
Right Guide Roller	PLC
Left Guide Roller	PLC
Left Dancer Pulley	Feed Spool, Right Guide Roller, Position Sensor, PLC
Right Dancer Pulley	Take-up Spool, Left Guide Roller, Position Sensor, PLC
Take-up Spool Traverse Pulley	Take-up Spool, PLC
Feed Spool Traverse Pulley	Feed Spool, PLC
Dove Tail	Fixture Mount, Work Piece
Fixture Mount	Dovetail, Work Piece
Feed Side Inline Spool	Feed Spool, Feed Side Guide Pulley, PLC
Take-up Side Inline Spool	Take-up Spool, Take-up Side Guide Pulley, PLC
Slurry System	Frame
Door Safety Latches	PLC, Frame
Frame	Everything
Control Panel	PLC