Large Pulley Frame overview

The pulleys are made of steel, mounted on solid 20mm shafts, which pass through 20mm bore pillow block bearings. The pulleys are held onto the shaft with circlips, and can be removed if necessary. There are also two motorcycle front wheels, mounted on 12mm shafts.

Rotary movement is provided by four automotive windscreen wiper motors. These have smaller drive pulleys mounted on 12mm shafts, and drive the larger pulleys via polyurethane belts.

The 12mm shafts have been fitted to the motors by drilling and tapping an M8 internal thread, and also creating a taper using a conical drill. The conical profile allows the shaft to interface with the sloped shoulder on the wiper motor. There is also a 2mm roll pin hammered in place to make sure the shaft remains connected. The other end of the shaft has been secured to the aluminium drive pulley using a larger roll pin hammered in place. The roll pins can be removed with a parallel pin punch if / when necessary.

Note that the motors need the plastic collars to electrically insulate them from the frame, as the motor casings are connected to 0V. This is necessary so that the polarity can be swapped to reverse the motors, and so that different motors can travel in different directions at the same time.

The motors are driven by BTS7960 motor drivers, which allow PWM speed ramping. Ramping the speed will make the motors and other mechanical parts last longer.

No calibration / limit switches required for this item.

Maintenance

If any belts need replacing, 6mm polyurethane belt can be joined by heating up the ends on a large soldering iron tip. The melted ends are then slid off the tip and pressed together.

The motors will eventually need replacing when they wear out. They are very commonly available, with a universal bolt fixing pattern. Replacement motors will need a 2mm hole drilled in the shaft to match the drive shaft, so that a pin can be re-inserted. Omission of the pin will cause the shaft to unscrew.

After 5 years, check the bearings. Add oil via the grease nipples if necessary.

Rotary switch modes

Not applicable.

Things to watch out for

During testing one of the pulleys (lower LH purple) was squeaking, as it was rotating on the 20mm shaft rather than the shaft rotating in the bearing. This was an oversight - the pulleys should all have had shaft collars to attach them properly, but the issue has been cured for now by securing the pulley to the shaft with an epoxy adhesive. The remaining pulleys are heavy enough to run properly in the bearings.

Troubleshooting

Check fuses. Note that if a fuse has blown, something caused it to blow, and so replacing the fuse is not necessarily the solution to the issue.

If a motor is running but not the corresponding pulley/s, check belt tension.

An LED and 1K resistor can be used to check the PWM outputs. The LED brightness should fade up and down. Try reversing the LED polarity if it doesn't light up, as the LED has to match the motor direction.

Notable components

Generic 12V automotive windscreen wiper motors (type with 3 bolts)
Generic BTS7960 PWM motor drivers
Generic 6mm PU belt (orange colour)
5A automotive fuses

Colours

Pulleys:

1K cellulose RAL Signal Yellow 1003
1K cellulose RAL Capri Blue 5019
1K cellulose RAL Ruby Red 3003
1K cellulose RAL Pastel Violet 4009
1K cellulose RAL Pale Green 6021

Aging details on pulleys: 1K cellulose RAL Chocolate Brown 8017

Steel frame: 1K cellulose generic satin black