



Minitrac™ 8000

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About This Manual

This manual has been prepared to assist you in the operation and maintenance of your Eddyfi Technologies equipment. Correct and prudent operation rests with the operator who must thoroughly understand the operation, maintenance, service and job requirements. The specifications and information in this manual are current at the time of printing.

This product is continually being updated and improved. Therefore, this manual is meant to explain and define the functionality of the product. Furthermore, schematics or pictorials and detailed functionality may differ slightly from what is described in this manual. Eddyfi Technologies reserves the right to change and/or amend these specifications at any time without notice. Customers will be notified of any changes to their equipment.

Information in this manual does not necessarily replace specific regulations, codes, standards, or requirements of others such as government regulations

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Description

The Minitrac™ 8000 is a small, self-contained tractor module complete with its own electric motor and drive train. The track may be powered directly from a DC input or include its own embedded drive electronics.

Minitracs are designed for harsh environments such as confined spaces, underwater, hot or cold temperatures, mud and sand, mild radiation, and chemical solutions. Applications include storm and sewer pipe inspection, Oil & Gas inspection (Onshore/Offshore), potable water pipe inspection, nuclear facility inspection / waste cleanup and OEM / custom-built systems.

Standard length Minitracs measure 420 x 100 x 84 mm (16.5 x 4.0 x 3.3 in), these can be fitted with an extension which increase track length to 510 mm (20.1 in). Minitracs are made in three materials to meet application needs: aluminum, brass, or stainless steel; and can have clutched or non-clutched drive wheels. In all versions, the final drive power is delivered through a deep lug rubber track belt. Minitrac modules may be operated in pairs to make a steerable platform or used in multiple pairs to make a steerable train. Tracks are available in two voltage ranges: 36 – 70 VDC and 180 – 400 VDC.

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Specifications

Operating Voltage	Standard		36 – 70 VDC
	High Voltage		180 – 400 VDC
Operating Power			225W Peak
Operating Current	Standard		6.3 A Peak
	High Voltage		1.3 A Peak
Maximum Speed			6.4 m/min (20.9 fpm)
Pull Rating			See <i>Basic Load Specifications</i> below
Payload			Up to 70 kg (150 lb)
Operating Temp			0 ° – 50 °C (32 ° – 122 °F) 90 °C (195 °F) Maximum Internal
Storage Temperature			-20° – 60 °C (-4 – 140 °F)
Duty Cycle	In Water		100%
	In Air		Dependent upon load and heat sinking
Communications			RS-485 Device Protocol
Feedback			Temperature, motor current, motor speed
Depth Rating			60 m (200 ft)
Weight	Standard Length	Aluminum	5.7 kg (12.5 lb)
		Brass	12.2 kg (27 lb)
		Stainless Steel	11.8 kg (26 lb)
	Extended Length	Aluminum	7.2 kg (15.8 lb)
		Brass	16 kg (35.3 lb)
		Stainless Steel	15.4 kg (33.9 lb)
Lubrication			ISO 150 food-safe gear oil

Certification

The product is built in accordance with:

Machinery Directive 2006/42/EC, and

Electromagnetic Compatibility Directive 2004/108/EC and Directive 2014/30/EU



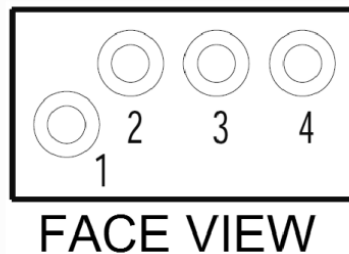
Connector Pin-Out

Standard Tracks

The Standard Minitrac™ 8000 uses a 4-pin, low-profile Subconn LPBH4M connector. Contact Eddyfi Technologies for details of the RS-485 control protocol.

Note: Pin-out is shown for the Bulkhead Connector on the track.

Pin	Function
1	70 VDC (+)
2	70 VDC GND (-)
3	RS485A (+)
4	RS485B (-)

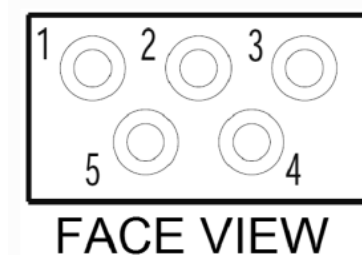


High Voltage Tracks

The High Voltage Minitrac™ 8000 uses a 5-pin, low-profile Subconn LPBH5M connector. Contact Eddyfi Technologies for details of the RS-485 control protocol.

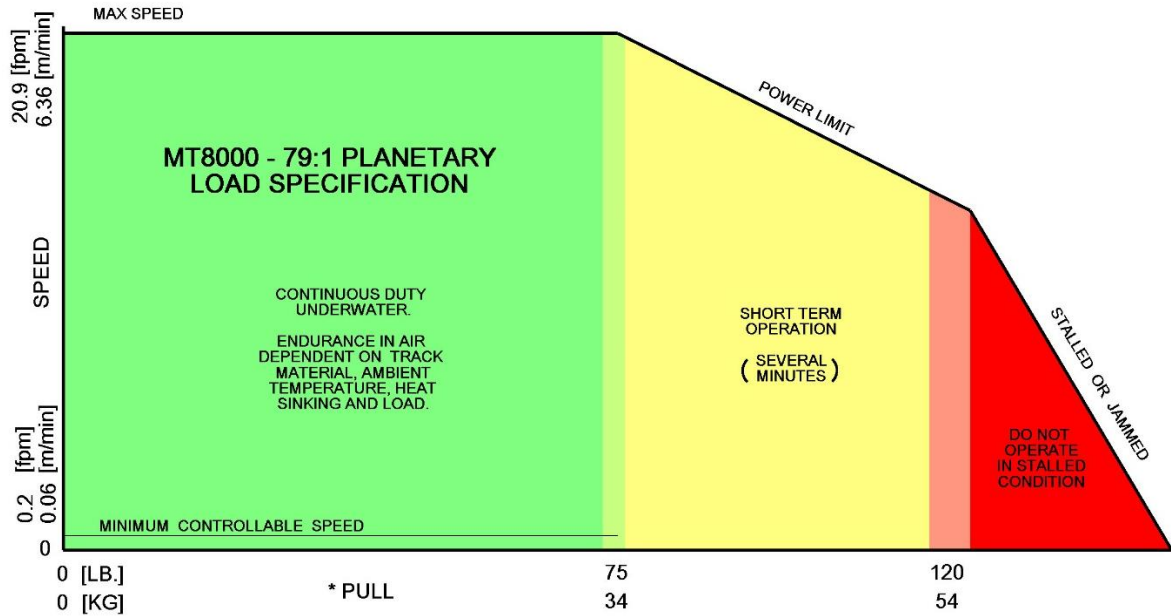
Note: Pin-out is shown for the Bulkhead Connector on the track.

Pin	Function
1	400 VDC (+)
2	400 VDC GND (-)
3	RS485A (+)
4	RS485B (-)
5	Spare



Load and Speed Specifications

Basic Loading Specifications



The above diagram details the speed and loading specifications of the standard Minitrac™ 8000. There are three regions defining performance:

- **Continuous Duty:** Preferred continuous operating range.
- **Short Term Operation:** Operation permitted for several minutes.
- **Stalled / Jammed Condition:** Automatic limiting is engaged to protect the motor and gearing. Do not operate the track in the stalled or jammed condition.

Influences on Loading

For a typical tracked vehicle there are multiple factors that can increase load and influence track performance. These include the following and are detailed below:

- Additional Payload
- Inclines
- Effects of Differential Steering (skid steering with parallel tracks)
- Curved Geometry of a pipe
- Elevated Temperature / Poor Heat Sinking / Thermal Shut-Down

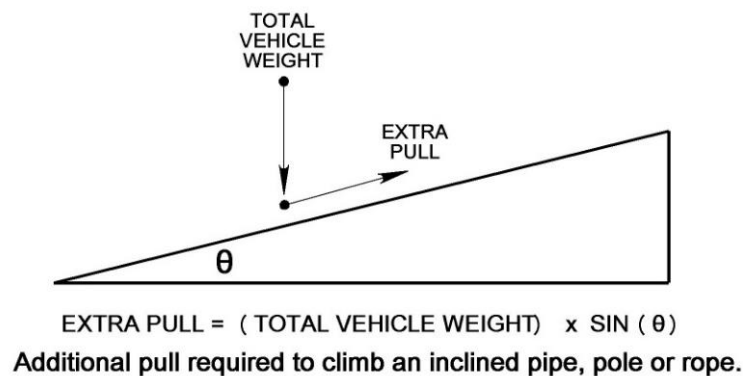
Additional Payload

Additional Payload may be added to the track, but the expected pull performance must be de-rated as per the calculation below. Additional payload also affects differential steering, inclines and curved pipe geometry (see below).

$$\text{Pull Reduction} = 0.25 \times \text{Extra Weight}$$

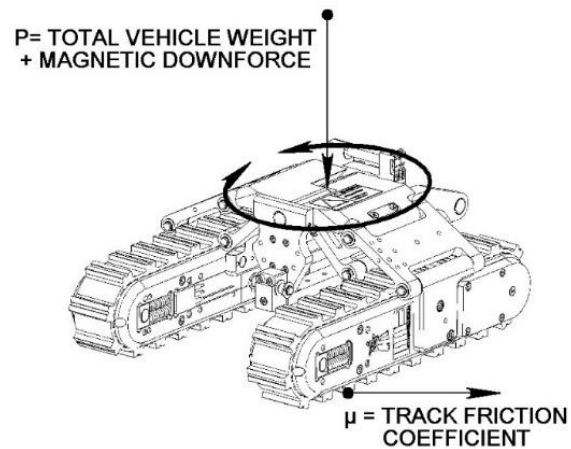
Inclines

Inclines cause the track to lift the vehicle weight against gravity and increase the track pulling load. Calculate the incline load using the equation below. Magnetic downforce does not affect loading from inclines — only forces from gravity. Note that the constant load from gravity becomes a significant factor on vertical surfaces because the motor is working to resist the load even when the track is stopped.



Differential Steering

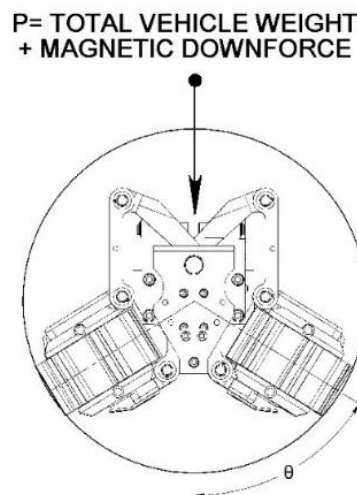
Differential Steering means steering by varying the speed of two tracks such as with a tank or bulldozer. During the steering process the tracks are dragged sideways in addition to forward / backward movement. The sideways movement adds to the total track load and requires extra torque from the motor. The greatest increase in loading occurs during a spot turn; the load being calculated as per the figure below. A typical 41 kg (90 lb) VT150 MKII vehicle on a surface with friction coefficient $\mu = 0.5$ will experience an additional 12 kg (27 lb) load per track to execute the spot turn. The same maneuver done on fine dry concrete or low-pile carpet will result in over 23 kg (50 lb) of extra motor load! (When steering on a vertical surface include only the magnetic downforce for the differential steering load calculation.)



Additional Load On Each Track
For Differential Steering = $0.6 \times \mu \times P$

Curved Geometry

Curved Geometry inside a pipe will increase the payload on a track depending on the angle of contact with the pipe. For nearly flat tracks the increase is small. For a contact angle of 60° , the load is doubled. The same calculation is used for a track contacting the outside of a pipe. Include both vehicle weight and magnetic downforce for this calculation.



Load on each track = $P / (2 \times \cos \theta)$

Elevated Temperature & Thermal Shutdown

'Duty Cycle' refers to the length of time a track can run before overheating. The duty cycle of the Minitrac™ 8000 track depends on:

- Track Material Thermal Conductivity (Aluminum, Brass = Good; Stainless = Poor)
- Ambient Temperature
- Track Load & Speed
- Wet / Dry Operation
- Heat Sinking

A track typically converts about 25% of the electrical input into motive mechanical power with the remainder being converted into waste heat transferred to the environment outside the track. When run continually at maximum power in a warm environment - up to 50 °C (120 °F), the tracks can heat up to the maximum temperature within ½-hour. However, this does not represent normal operation. Typical usage will include much starting and stopping for visual/NDT inspections and moderate loading for most of a pipe run for pulling tether – so reaching the thermal limit of the track is not expected to be a common operational concern. When tracks are bolted to a chassis, it further acts as a heat sink to help cool the tracks.

When a track's internal temperature reaches 90 °C (195 °F) it will automatically shut down and wait until its internal temperature drops below 75 °C (170 °F) before restarting. If the tracks are operating underwater, such as in a flooded pipe, heat transfer is excellent, and the duty cycle may be considered continuous.



Note: Stainless steel tracks will require special consideration for cooling, as they reach thermal shutdown sooner due to the extremely poor thermal conductivity of stainless steel.

Safety

In order to be able to use this product properly and safely, every user must first read these operating instructions and observe the safety instructions contained therein. Take care of these operating instructions and keep them in a place where they can be accessed by everyone.



CAUTION: Failure to follow these safety instructions may result in injury or equipment damage.



WARNING: High Voltage



400 VDC can cause serious injury or death. Do not operate with a damaged tether or Minitrac™ whip. Do not operate the system with damaged wires. Damaged cabling poses a shock hazard. Repair damaged cabling before operating the vehicle. A short circuit may also damage the controller, cameras, or any attached equipment.



Disconnect the power source before servicing the product; otherwise, damage or fatal injury may result.

The power supply is equipped with a ground fault interrupt circuit. Do not cheat or bypass the ground fault interrupt circuit. Do not power the equipment from a source other than the Eddyfi Technologies provided power supply.



CAUTION: High Temperature. Under rated operating conditions this track can become very hot, up to 80 °C (175 °F).



WARNING: Spark Hazard - Under no circumstances should this equipment be used in a potentially explosive atmosphere.

- The Minitrac™ 8000 is an industrial product. All personnel operating or maintaining this equipment must be competently trained.
- There are no user serviceable parts inside. This product may be serviced only by qualified technicians or trained personnel.
- Eddyfi Technologies equipment is used in many varied environments from hot/dry to confined spaces to deep underwater. Such diverse environment risks must be addressed by the operators who are trained to work in such surroundings. As such, the operator is responsible to determine safe site setup and appropriate procedures for operation and maintenance of the equipment.
- Appropriate personal protective equipment (PPE) must be worn while operating and maintaining the equipment.
- Do not use the product or any component exposed to pressures higher than the rated working pressure.

In addition, observe the following precautions when cleaning or servicing the Minitrac™ 8000

- Do not operate the track with a damaged connector or cable. Inspect connectors and cables regularly for damage.
- Avoid creating a pinching hazard when designing a vehicle based on these tracks.
- Lay the track on its side if you are powering it up on the workbench.
- DC-Controlled tracks (without internal driver) must be protected by current limiting either by fuse or electronically by the power supply. Current limiting and fuses are included standard with system controllers.

Call the Eddyfi Technologies Service department for assistance or service if needed.

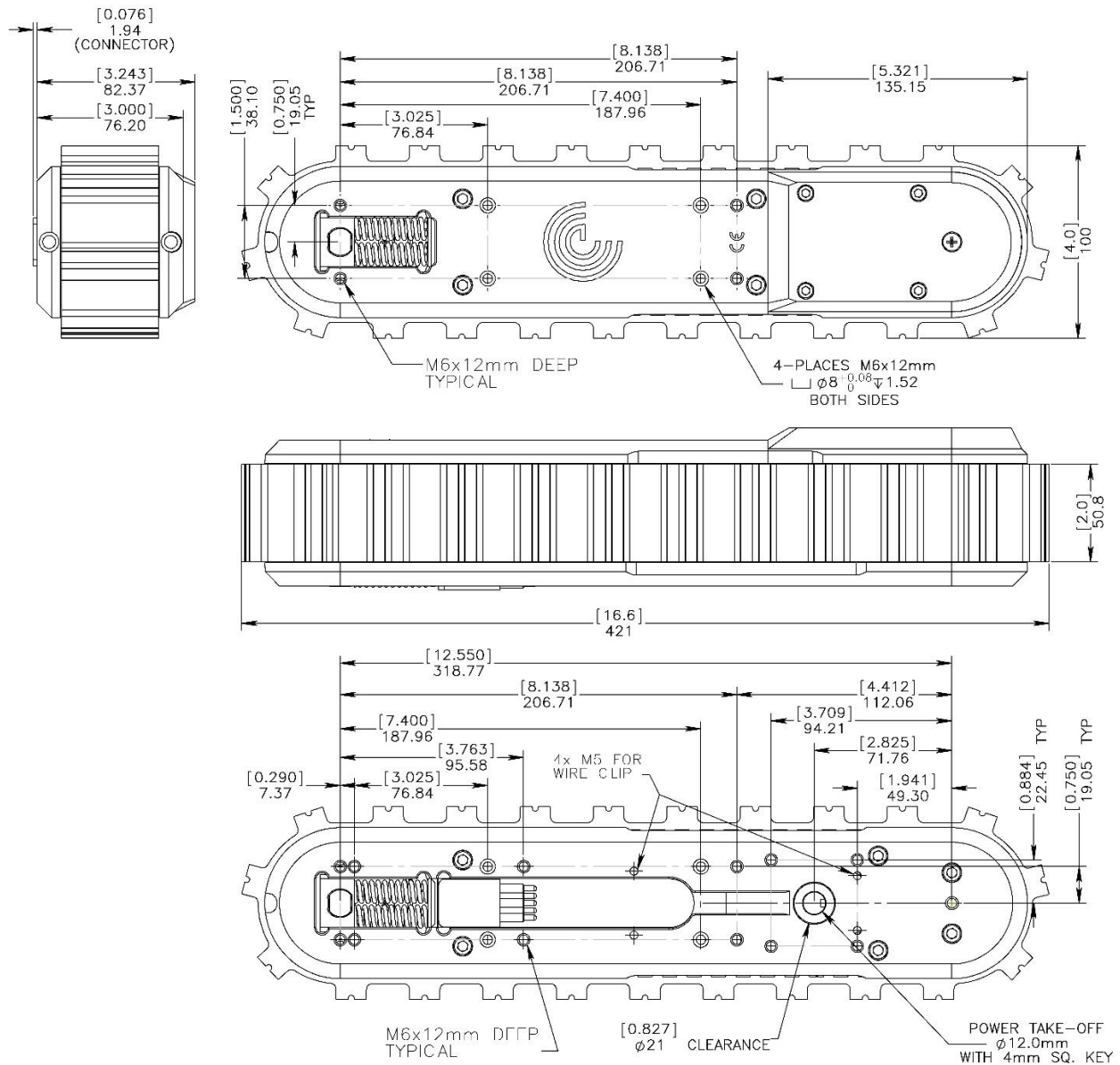
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System Setup

Mounting the Track

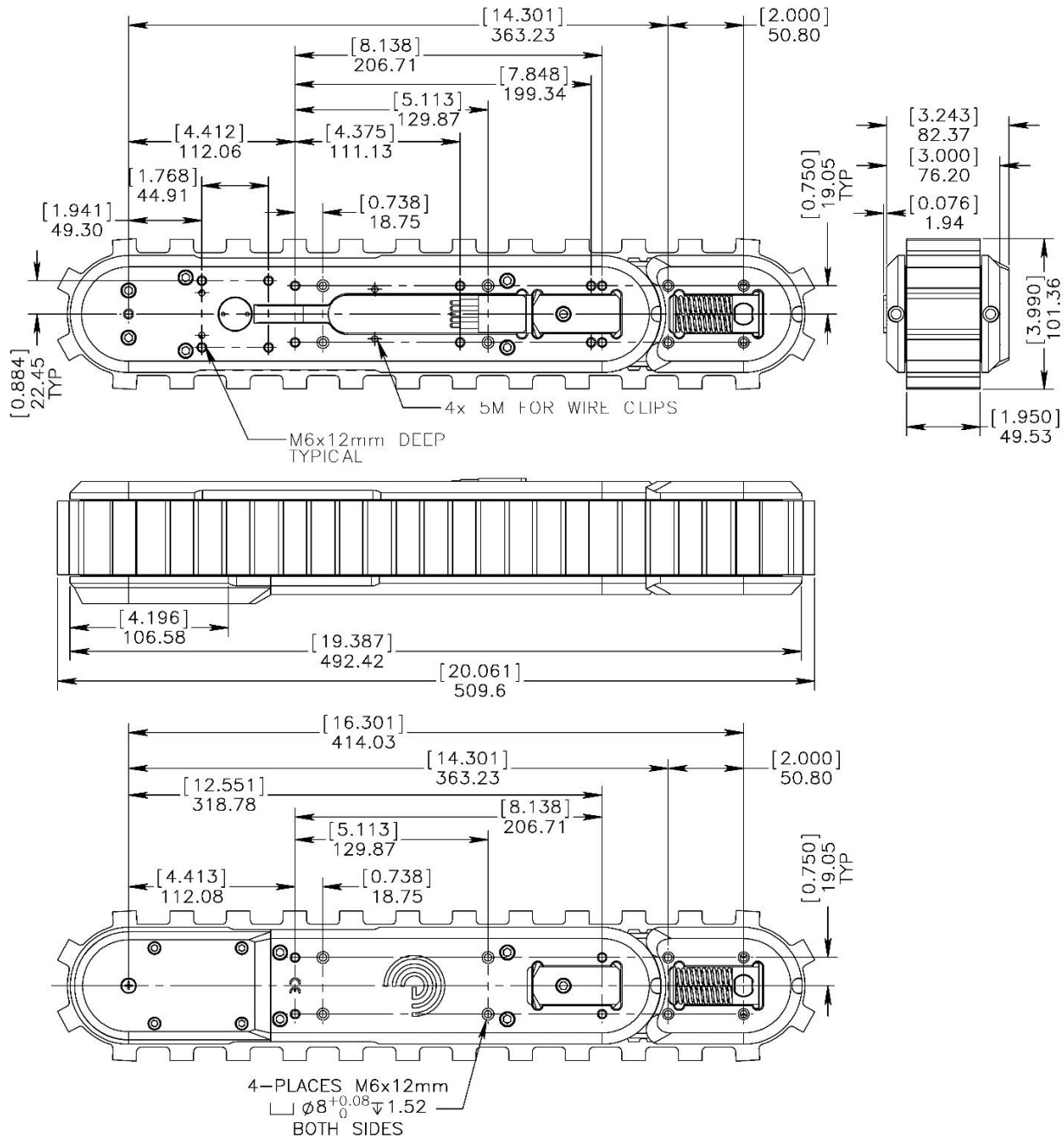
Standard Length

Overall dimensions for mounting the standard Minitrac™ 8000 are shown below. The pattern of 6x M6 mounting holes is repeated on both sides. Maximum screw penetration in the side plate is 12 mm; longer screws will bottom out or bind against the idler wheel.



Extended Length

Overall dimensions for mounting the extended length Minitrac™ 8000 are shown below. The pattern of 6x M6 mounting holes is repeated on both sides. Maximum screw penetration in the side plate is 12 mm; longer screws will bottom out or bind against the idler wheel. Manual tensioning blocks may be required for Extended Length tracks in certain conditions.



Connector Handling

Connectors are an essential part of system reliability. They should be properly maintained and cared for to ensure long life and reliability. It is recommended to follow these steps to help prevent damage and increase the life of connectors.

- Always put the cap back on the tether bulkhead when the tether is disconnected
- Always inspect the end of the connector prior to engaging
- Never plug in a dirty or damaged connector
- Visually align keyways or locating pins prior to engaging the connector
- Always fully engage or tighten the connector
- Secure locking collars finger tight
- Install dummy plugs on unused connectors
- Disconnect by pulling straight, not on an angle
- Do not pull on the cable to disengage the connector



IMPORTANT: Never “Hot Plug” any connector, this will result in internal damage to the electronics. Power down the system prior to connecting the inspection system tether.

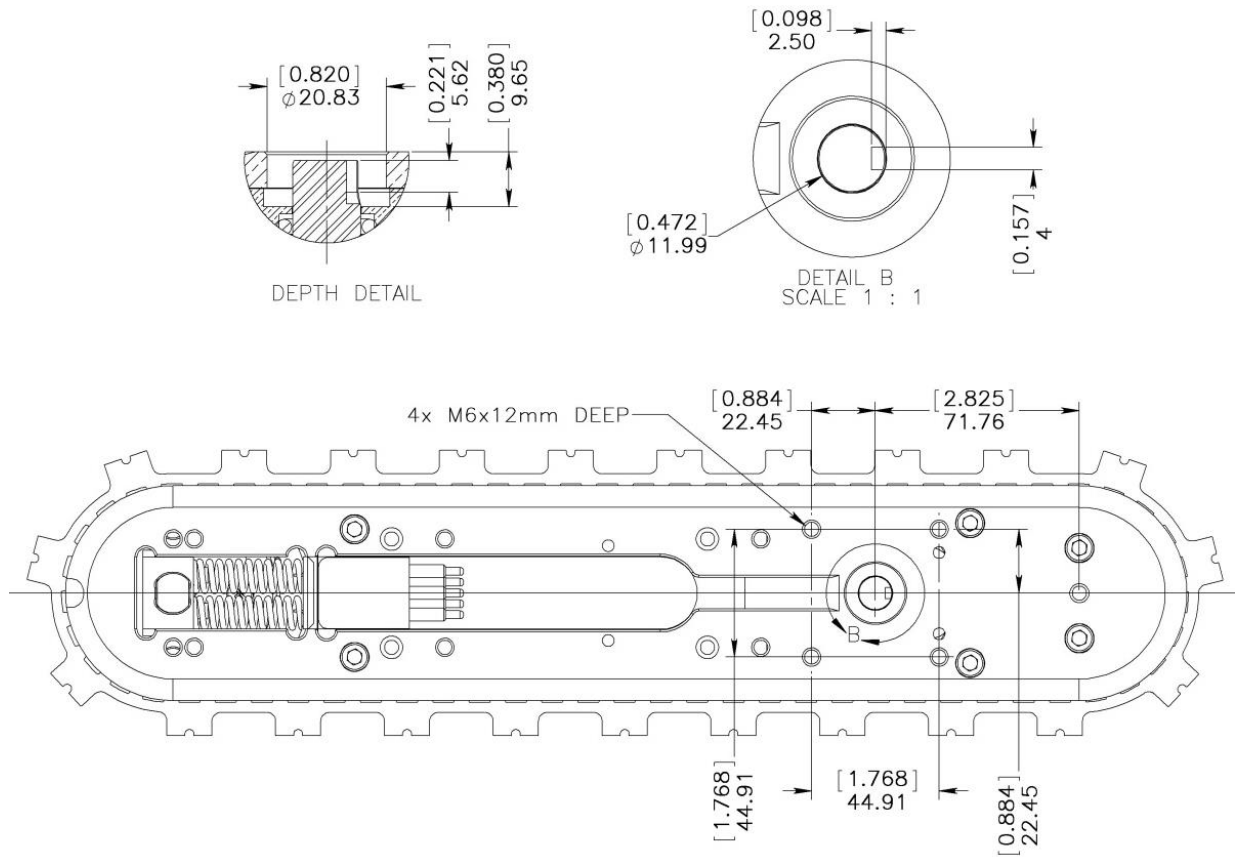
Note: Never use WD-40 or similar solvent-based fluids on connectors or crawlers. These will cause the rubber parts of the connector or crawler to soften and swell rendering them inoperable.

Subconn Connector: Lubrication and Cleaning

- Periodically apply Molykote 111 silicone grease or equivalent before mating connectors
- For dry mate connections, a layer of grease corresponding to 1/10 the socket depth should be applied to the female connector
- After greasing, fully mate the male and female connector and remove excess grease from the connector joint
- General cleaning and removal of sand or mud on a connector should be performed using a spray-based contact cleaner like isopropyl alcohol

Power Take-Off

The Minitrac™ 8000 features a power take-off shaft located just behind the drive wheel. The shaft taps power from the main bevel gear, positioned in front of the final drive gears. Engage with the shaft using a cup with a standard 4mm key. The speed of the shaft is roughly twice the drive wheel, but at half the torque. Specifically, the gear ratio for the power take-off is exactly twice the planetary ratio for your track. The power take-off may be used to drive other devices such as brushes, lead screws, wheels, etc., effectively turning the track into a multipurpose servomotor. We recommend that you remove the belt while using the power take-off.

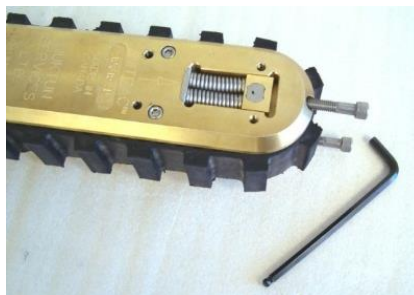


Belt Installation

Track with Spring Tensioner

To remove the belt, do the following as shown below:

1. Install the spring compression screws (M8 x 50 SHCS) at the front of the track and completely compress the tension springs as illustrated in the figures below. Note that the spring compression screws should be lubricated with never-seize or light grease before use.
2. With the tension springs compressed, the belt is loose enough to remove by sliding it off the drive (rear) wheel and over either side plate.
3. To install a new belt, place it over the idler wheel first, then slide the belt over the drive wheel. When the spring compression screws are backed off again and removed, the springs automatically tension the belt.



STEP 1



STEP 2



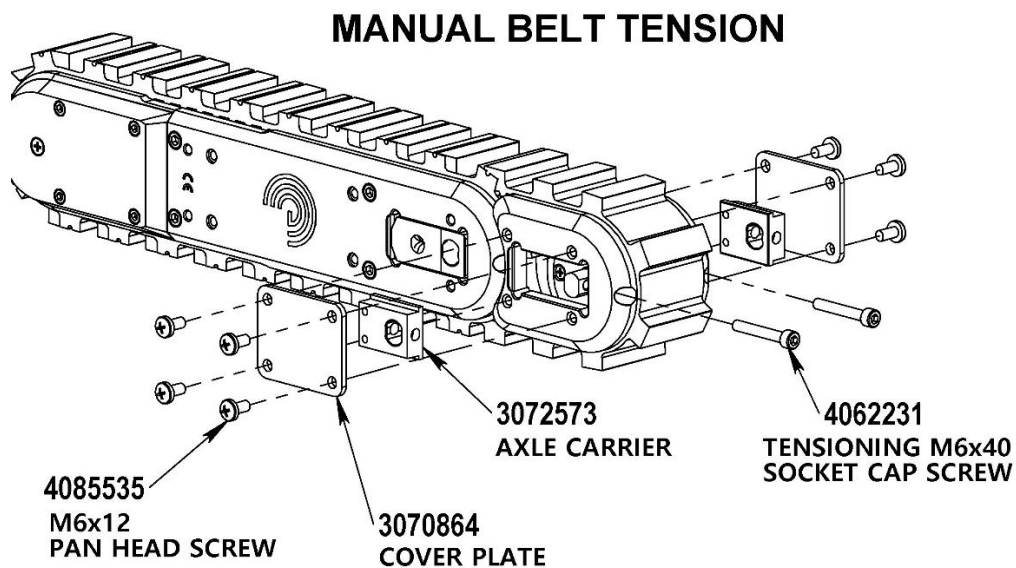
STEP 3

Track with Manual Tensioner

The manual tensioning block is an optional component for tensioning the track belt manually using tensioning screws instead of springs. This is often required on heavier vehicles and those employing skid-steer to prevent belt skipping when the track must operate at full power in both directions. Typically, the manual tensioning block is ordered with the track from the factory but may also be ordered and installed separately.

To remove the belt, do the following as shown below:

1. Remove the plastic idler cover plates 3070864.
2. Loosen the M6 x 40 mm SHCS tensioning screws 4062231 to release the belt tension.
3. The idler wheel will slide inward enabling the track belt to slip off the rear drive wheel.



Belt Installation & Tensioning

1. Belts are installed again by placing the belt over the loose idler wheel, then slipping it onto the rear drive wheel.
2. Apply Loctite 243 to the tensioning screws 4062231 to prevent loosening and thread galling.
3. Evenly tighten the tensioning screws until the belt tension feel snug. Belt tension should be adjusted until there is no obvious slack in the belt between the idler wheel and the drive wheel. When this is achieved, check the belt tension.

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4. Test the tension by pulling up on the middle of the belt with your thumb. Correct track belt tension will allow a gap between $\frac{3}{8}$ and $\frac{1}{2}$ inches [9 – 12 mm]. Check both sides of the belt for even tension.
5. **IMPORTANT:** verify alignment of the track belt and idler wheel. Misalignment will cause the track belt to rub against the side plates while the track is operating, degrading performance and potentially resulting in the track belt becoming completely jammed and stopping the unit.

Verify alignment using a caliper. Measure the gap between the front of the tensioning block and side plate. The gaps on both sides must be equal to within 0.5 mm (0.020 in)

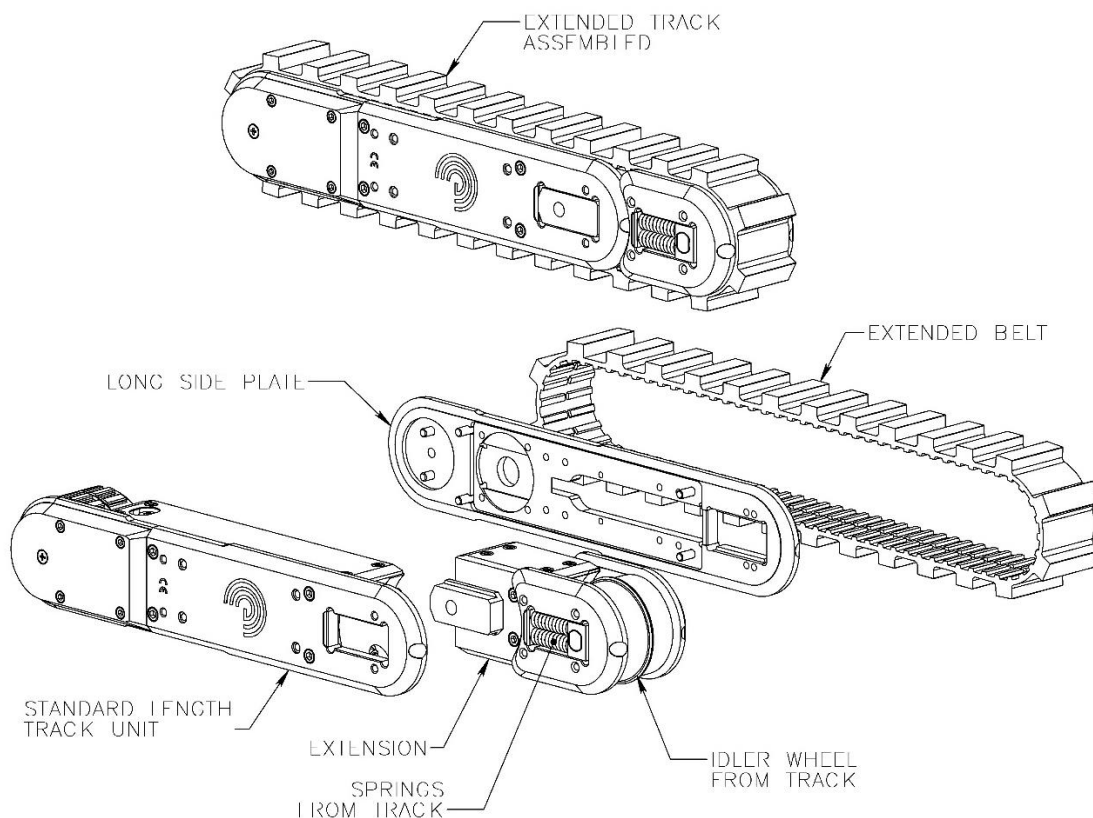
6. After the idler wheel has been aligned, re-check the track belt tension by pulling up on the middle of the belt with your thumb, achieving between $\frac{3}{8}$ and $\frac{1}{2}$ inches [9 – 12 mm]. With the wheel aligned, adjust belt tension by turning both screws evenly.
7. With the track on its side or lifted from the ground, operating the track at full speed and observe track alignment.
8. After the belt is aligned, replace the plastic side covers 3070864 to prevent dirt and small bits of gravel from falling between the idler wheel and belt.

Convert to Extended Track

An extension block can be installed onto the Minitrac™ 8000 crawler track to enable use of an extended track belt. This will extend the effective track length by 95.25 mm (3.75 in).

The extension block kit includes the block and extended track belt, to install do the following as shown below:

1. From your standard track, remove the belt, long side plate, idler wheel, and springs. The short side plate opposite the connector must remain on the track.
2. Install the springs and idler wheel into the extension block.
3. Install the assembled extension block onto the track. The block will clip into the slots where the springs were installed before.
4. Install the extended track belt. See Belt Replacement & Tensioning.



Maintenance

Rinsing and Cleaning

After every mission check to see if the tracks need cleaning. To maintain top performance of the Minitrac™ units, it is important to prevent excessive buildup of dirt under the track belt. A buildup will increase the belt tension, causing the track to lose speed and pulling ability. Ultimately excessive tension may stretch and ruin the track belt.

1. If the tracks have been used in salt water, thoroughly rinse the tracks with fresh water prior to being stored away. Accelerated corrosion will result if the inspection system is not rinsed properly. Pay close attention to rinsing and cleaning the spring and underneath the track belt.
2. Use an open hose or tap at regular water line pressure for rinsing – use a mild detergent and soft brush. Do not pressure wash the equipment – water will be forced into the track at these high pressures.

If it is necessary to apply aggressive cleaning fluids, consult the factory before use. Clean away any dirt, grit or build-up near joints or moving parts. Also clean the drive wheel teeth, wear strip and idler wheels.



CAUTION: Do not use a pressure washer to clean the track. Very high-pressure water can push past seals and flood the components resulting in track damage.

Scheduled Maintenance and Servicing

The scheduled maintenance suggested below is in addition to normal equipment operation inspections.

Daily

Daily or before each use of the Minitracs™

1. Visually inspect the Minitrac™ and track belt for damage; if the track belt is torn or stretched it may need to be replaced. Check for correct belt tensioning.
2. Ensure that fasteners are in place and secure.



CAUTION: Do not use the Minitrac™ if the cabling looks damaged in any way. High voltage to the track can cause serious injury or death.



Weekly

Verify by visual inspection that there are no traces of oil near or on the sides of the drive wheel and the track belt. This would indicate that the oil seals may have been damaged by debris or have become worn by abrasion.

Monthly

The monthly checklist provided below is suggested for all Minitrac™ types and should be performed more often if the tracks are used extensively (more than 100 hours per month).

1. If muddy, thoroughly wash down the track body and wheels. Use only standard water line pressure; do not use a pressure washer on the equipment. Remove and clean the track belt / skid plate if dirt is packed underneath.
2. Remove buildup or dirt from drive wheel teeth.
3. Check the oil level and condition of oil – see below.
4. For tracks equipped with a clutched drive wheel, test for the free turning of the track belt. It should be able to turn easily by hand in at least one or both directions. Any serious stiffness may be caused by a jammed idler wheel, jammed drive wheel, or a build-up of sand under the belt or skid plate. For tracks equipped with a direct-drive wheel, the belt should be able to be back-driven by hand while the power is off to test for belt stiffness. Operating with a jammed belt may cause the belt to tear.

Checking the Oil

The oil level in the Minitrac™ should be checked at least once per month if the track is under heavy use. The following outlines the procedure for checking the oil level.

1. The oil level is checked, drained, and filled by way of an oil port underneath the track belt either at the top or bottom. To access the port, the track belt must be removed.
2. Once the belt and skid plate are removed clean off dirt from around the oil port.
3. Remove the oil plug. Ensure that the plug's O-ring is clean and not damaged.
4. Inspect the oil. It is normal to see metallic wear particles from the gears. Under heavy operation in gritty environments, the oil may become dirty due to grinding sand at the seal interface. Change the oil if it is not clear with ISO 150 gear oil.
5. The oil level must be just covering the transverse shaft visible through the hole when the track is lying flat on a level surface.

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Filling the Oil

1. Following the procedure above, locate and remove the oil plug.
2. Drain the oil into a clean pan, tray, or clear empty container by turning the track over and allowing it to rest level for 20 minutes or so. This allows for the best possible visual inspection of frothing oil, dirt, etc.
3. When replacing the oil, **DO NOT OVERFILL THE TRACK**. Oil should just cover the transverse shaft visible through the oil fill-port. The oil will flow slowly inside the track requiring you to top up the oil twice more after leaving the track to stand for ten minutes between fillings.
4. Re-install the oil plug, wear strip and track belt.



NOTE: Over filling the track may cause oil leaks under heavy loads because of the volumetric thermal expansion of the oil.



NOTE: Minitrac™ 8000 crawler tracks are factory filled with ISO-150 weight food-safe gear oil. Eddyfi Technologies recommends the continued use of food-safe gear oil when the tracks are used in a clean environment. Otherwise, the tracks may be refilled with **SAE 80W** gear oil. Tracks sent to Eddyfi Technologies for servicing will be refilled with **ISO-150 food-safe** gear oil.

Overhaul

For extended service and maximum reliability of your Minitracs™, Eddyfi Technologies offers a factory overhaul of the Minitracs™. The factory overhaul constitutes an investment by the equipment owner in preventative maintenance. As such, the overhaul should be considered discretionary. We recommend that the Minitracs™ be thoroughly serviced once a year or after 500 hours of operation. This includes complete disassembly, cleaning and inspection of the Minitrac™ components with focus on the drive train and motor, and the replacement of O-rings and seals. In the overhaul, the track unit is completely disassembled. All internal components including the belt, motor, driver, gears, bearings, and seals are inspected and replaced where necessary.



WARNING: SHOCK HAZARD. High voltage components inside. This product may be serviced only by qualified technicians or trained personnel.

Parts and Repairs**Ordering Parts/Customer Service**

Spare and/or replacement parts are available for your product and can be ordered directly from your local office.

When ordering parts always make sure to quote the sales order acknowledgement (SOA) number and/or the serial number of the system component in question.

Eddyfi Robotics Inc. (Canadian Headquarters and Manufacturing Location)

2569 Kenworth Road, Suite C

Nanaimo, BC, V9T 3M4

CANADA

TF 1.877.468.5886

T +1.250.729.8080

info@eddyfi.com

www.eddyfitechnologies.com

Eddyfi Technologies – US (American Authorized Distributor and Service Centre)

812 W 13th Street

Deer Park, TX, 77536

USA

T +1.281.542.3292

info@eddyfi.com

www.eddyfitechnologies.com

Warranty Repairs

Warranty conditions are specified in the Warranty section. Should any conditions of the manufacturer's warranty be breached, the warranty may be considered void. All returned items must be sent prepaid to Eddyfi Technologies at the above address.

Factory Returns to Canada

Some sub-assemblies of your Eddyfi Technologies product are not field-serviceable and may need to return to the factory for repair. Warranty claims must return to the factory for evaluation.

To return an item for evaluation or repair, first contact Eddyfi Technologies at our toll-free number or e-mail address. Eddyfi Technologies will supply a Return Merchandise Authorization (RMA) number with detailed shipping and customs instructions. Items shipped without an RMA number will be held at Eddyfi Technologies until the correct paperwork is completed. If cross-border shipments are not labelled as per the instructions, the items may be held by customs and issued additional fees.

All returned items must be sent prepaid unless other specific arrangements have been made.

When the product or system is being shipped anywhere by courier or shipping company, it must be packaged in the original packaging it was received in. This measure greatly reduces the consequences of rough handling and subsequent shipping damage.

Eddyfi Technologies cannot be held responsible for damages due to improper packaging. Shipping damage may have significant impact on repair turnaround times.

Product/System Drawing Package Availability

Mechanical assembly and electrical wiring diagram drawing packages for your equipment are available in PDF format upon request. Printed copies may also be purchased from Eddyfi Technologies. Contact your local sales contact for more information.

Limited Warranty Policy

Refer the Eddyfi Technologies website for warranty terms for this product.

<https://www.eddyfi.com/en/salesterms>

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