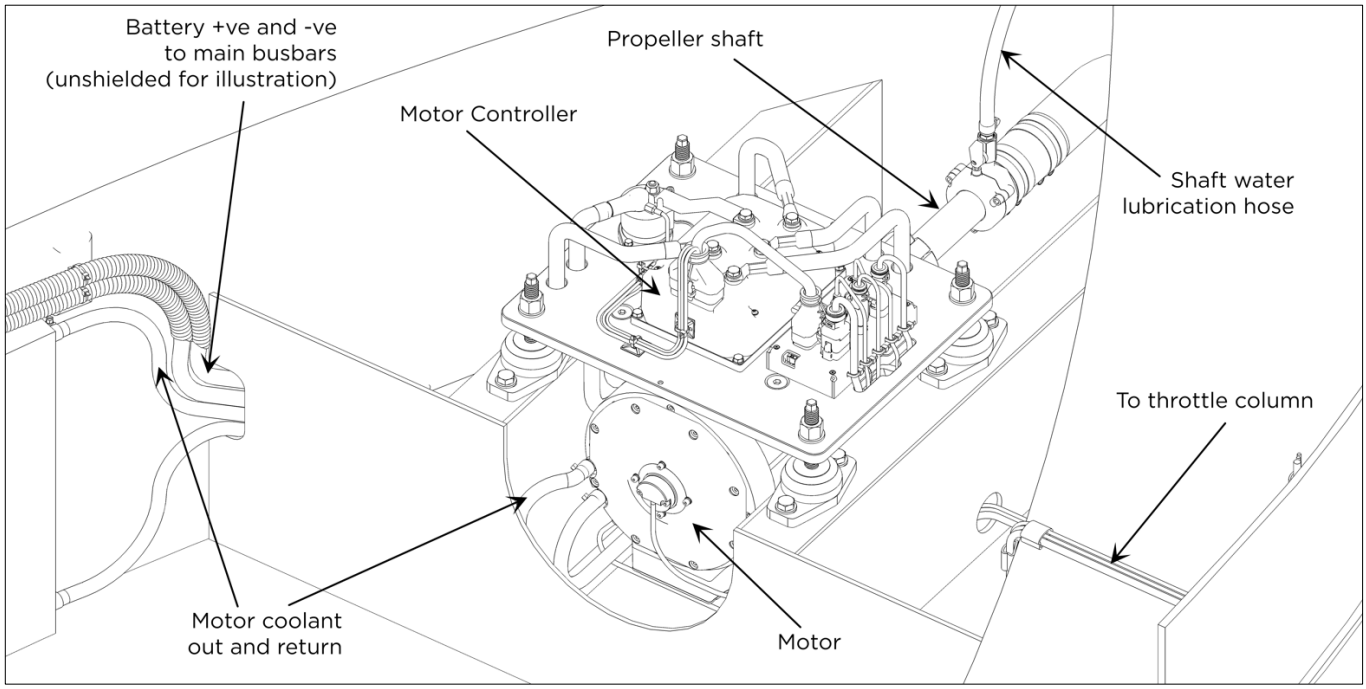
Törkmar Motor Installation Guide

Document Version 1.1 : 28/10/25

1 System Overview



1.1 What is included

- 15kW PMAC Motor
- Motor Controller
- Contactor
- Controller Interface with 5 Amp fuse and clear cover
- Törkmar GRP cover
- Aluminium heat sink mount
- 1 x half-coupling
- Throttle plate and throttle
- Coolant pump and switch

1.2 What is optional

- 2nd half coupling
- Propeller
- Propeller shaft
- Cutlass bearing/shaft seal kit
- 4 x R&D motor mounts
- Victron Ekrano screen
- Curtis 3141 Display
- 5m ethernet cable
- GPS

1.3 Description of parts

1.3.1 Motor

This is a PMAC motor with a built-in thrust bearing. It has a constant torque rating of 143n/m and is water cooled. Water cooling will start automatically at 35℃ and stop at 30℃. The water pump can also be operated manually.

There are three sets of connections from the motor that are pre-connected on the motor assembly:

- Three phase power to the motor windings
- Shaft encoder outputs
- Temperature sensor

The shaft encoder tells the motor controller where the rotor is with respect to the windings; due to small manufacturing differences between motors this will have to be calibrated by the motor controller during the motor commissioning phase performed by Törkmar prior to delivery. This means that neither the motor nor controller can be replaced by another one without re-commissioning the complete setup otherwise it is likely that the controller will fail catastrophically when the motor is under load (this would not be covered under warranty). Please contact Törkmar if there is an issue with either of these components.

The shaft encoder and temperature sensor cables connect to the controller via the Controller Interface board, the power cables connect directly to the motor.

1.3.2 Motor Controller

As its name suggest the motor controller allows the motor to be used safely and efficiently. It allows the helmsperson to use a throttle to control the motor speed. It has a powerful processing function and Törkmar has programmed it to power and control the water coolant.

1.3.3 Contactor

The battery +ve is connected to the contactor. It works like a fuse, and it's used to protect the controller and motor controller from over-current. On turning on the key switch, a small low voltage current passes through the motor and controller to verify the system. If all is well, the contactor will 'click in' and allow high current 48V to pass into the system.

1.3.4 Controller interface board

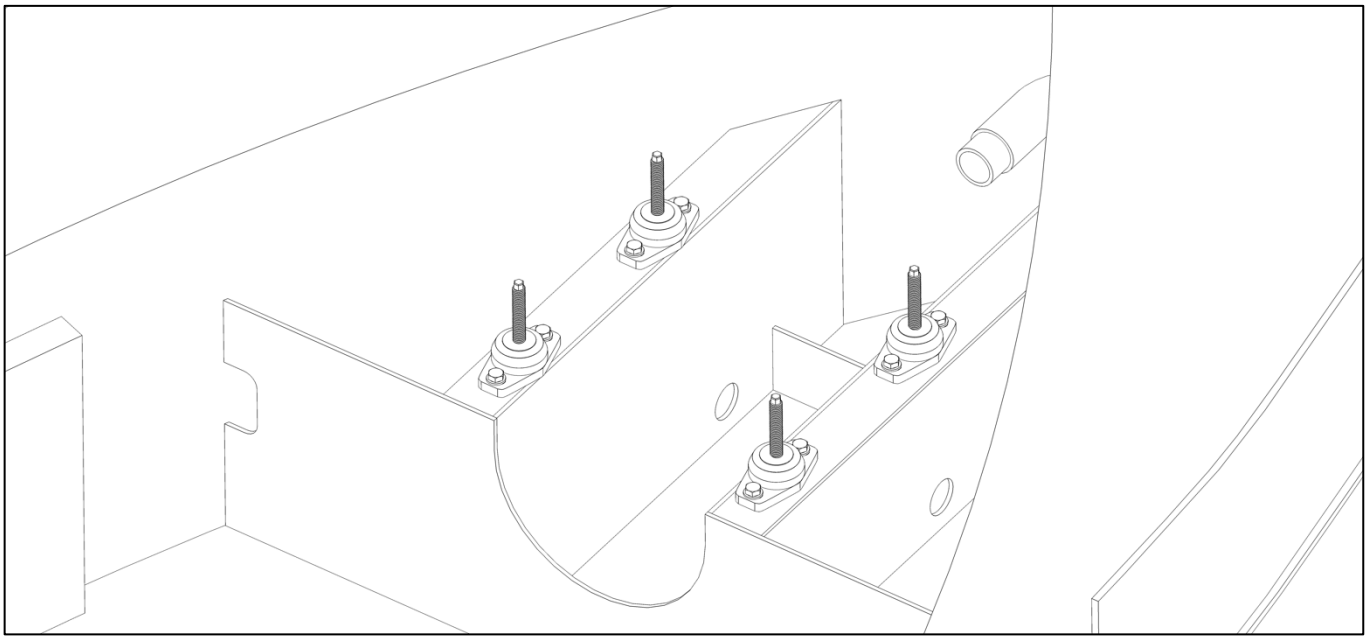
This board is where all elements of the propulsion system connect. Connections are via Ampseal plugs, Deutsch plugs and RJ45. There is also a key switch fuse (5A) and 2 self-resetting fuses for the CAN cables.

1.3.5 Throttle

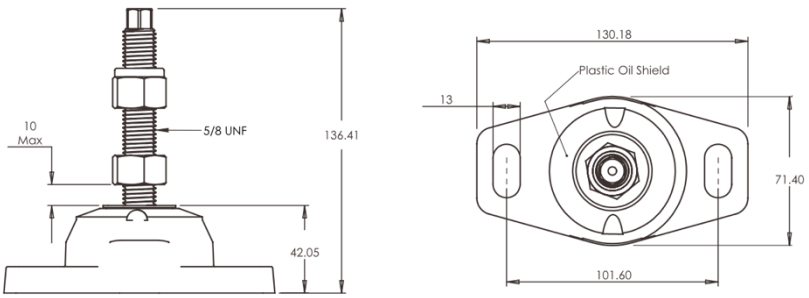
This is a 5V potentiometer and sends a signal regarding motor speed and direction to the controller. On the throttle plate there is a key switch and 4 spaces for Carling V series Contura II switches one of which is used for the water pump. 3 blanks are provided as standard.

2 Motor Installation

2.1 Motor mounts

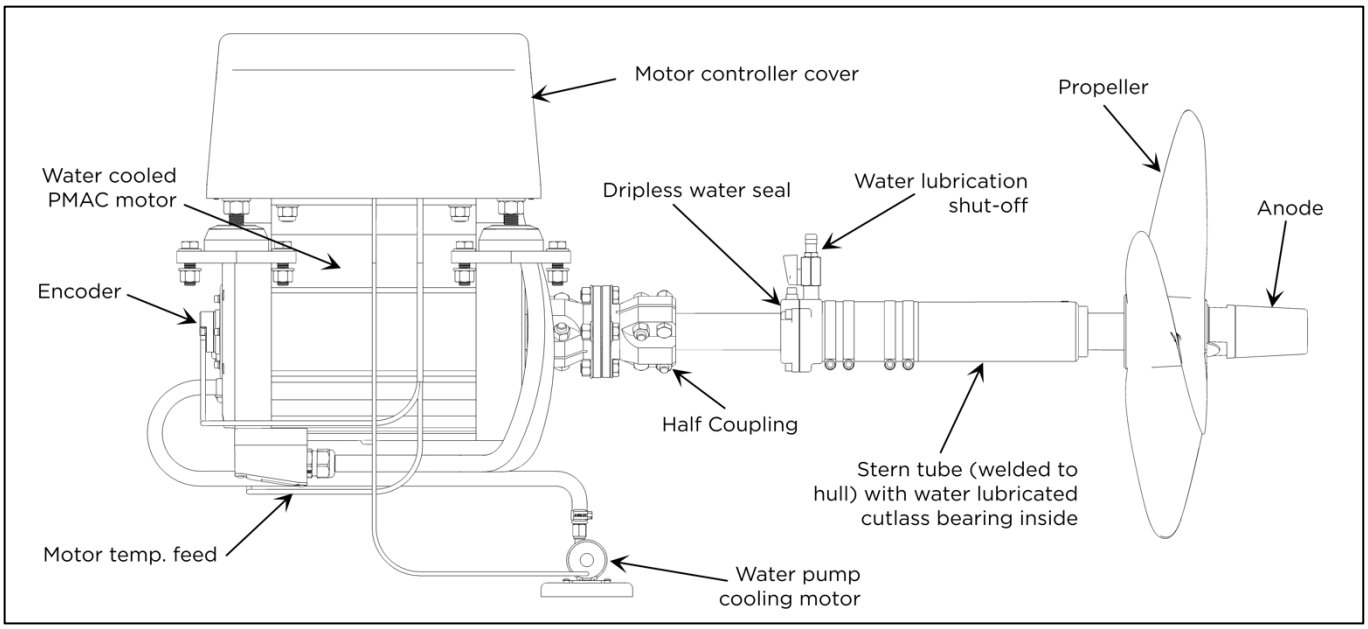


Check that measurements are in accordance with the drawings provided: Motor mounts need to be fixed with 10mm stainless steel bolts and locking nuts. Loosely fit to allow for motor and shaft alignments later. Refer to the Törkmar Motor Mount technical drawings for the required mount layout.



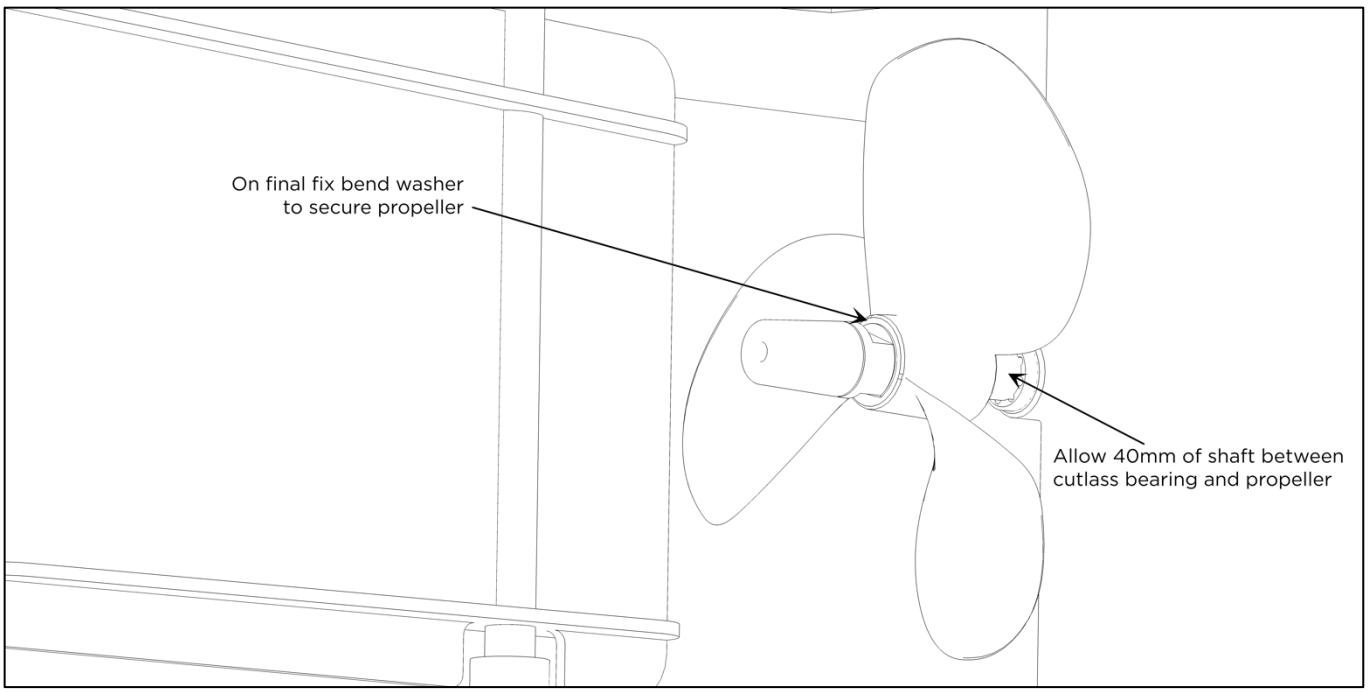
Dimensions (in mm) of supplied motor mounts with 5/8” stud.

2.2 Motor and shaft

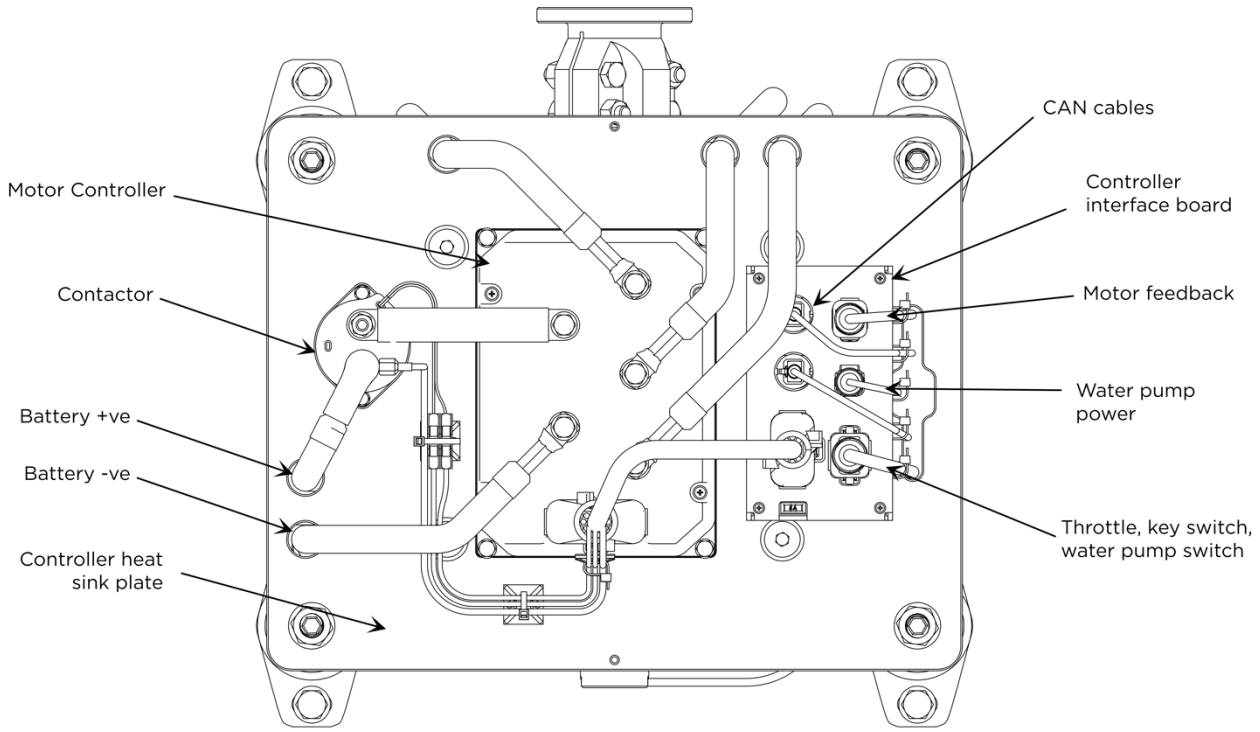


- **Important:** use provided silicone lubricant and shield to protect seals.
- **Cut shaft to suit:** pay special attention to burrs as they will damage the shaft
- **Align motor and shaft:** Secure in place and fix together half couplings.
- **Use 12mm ID hose:** Route from motor to pump then 'skin tank'
- Dry fit propeller:

2.3 Propeller



Electrical



2.3.1 Power Cabling

The main battery power cables to the Controller assembly should meet the following specifications:

- Extra flexible with outer insulation rated for at least 70ºC
- Minimum of 70mm^2 of copper conductor
- ISO 13297:2021 - *Small craft - Electrical systems - Alternating and direct current installations*
- Routed in conduits or supported at least every 450mm
- Red coloured insulation for +48V, black for ground.

The power cables should be connected as follows:

- Connection from the battery +ve to the contactor: use a red battery cable terminated with a M8 lug routed through the hole close to the contactor. Note that this will share the contactor stud with the key switch battery feed (this is a red 0.7mm ring terminated cable that routes via the controller Ampseal harness). The correct torque range for the main contactor terminals is 8-9.5Nm – the battery cable must be the lower of the two connectors on the contactor (with the smaller key-switch connection on top).
- Connection from the battery -ve (black) to the motor controller: use a black battery cable routed through the other heat sink plate hole terminated with a M6 lug. This should be tightened to a torque of 10.2 ± 1.1Nm (90 ± 10 in-lbs.) on the motor controller.
- **Check other power leads:** ensure all cables that are factory fitted connecting to the motor controller are securely fastened. The correct torque range for the motor controller power is 10.2 ± 1.1Nm (90 ± 10 in-lbs.).

2.3.2 Interface Cables

Ensure that the plugs on all factory fitted cables are securely seated in their sockets. The cables can't be plugged into the wrong sockets as they have different pinouts. All interface cables should be routed through the key-shaped hole in the Controller head-sink plate.

2.3.2.1 Controller Main Harness

This connects the motor controller to the Controller interface board/Contactor and is factory fitted.

2.3.2.2 Motor Feedback cable

This connects to the motor shaft encoder and temperature sensor and is factory fitted.

2.3.2.3 Water Pump Power

Powers the motor coolant pump. Once the water pump has been installed, the water pump extension cable should be used to connect to the interface board to the factory fitted plug on the pump. The coolant itself (not provided) should be a mixture of water and antifreeze and should give protection to -12°C.

2.3.2.4 Throttle cable assembly

Consists of a throttle extension cable (standard length 2m) and a cable assembly factory wired to the throttle and connected using spade connectors to the key switch and pump switch. These connect the interface board to:

- Throttle (prewired)
- Key switch: Brown and Red 5mm spade terminated cables (can be connected either way)
- Pump switch: Purple/white and Red/White 6.3mm spade terminated cables
- Pumps switch LED: Brown 6.3mm spade terminated cable from the key switch is to the LED+ connection. Green/Red 6.3mm spade terminated cable is to the LED- connection

The LED indicator is illuminated when the pump is enabled either by the pump switch or automatically by the motor controller when it senses that the motor is above a temperature threshold. Once mounted on the boat, the throttle extension cable should be used to connect the throttle cable assembly to the Controller Interface Board.

2.3.2.5 CAN Cables

Both RJ45 CAN sockets on the Controller Interface Board are connected to CAN 1 of the motor controller and have an internal terminating resister enabled by default. This can be disabled by breaking the connection on jumper JP4.

The RJ45 pin allocations are as follows (standard Victron):

Pin 7	CAN 1 H
Pin 8	CAN 1 L

The other RJ45 pins are normally not connected though there are jumpers on the Controller Interface Board using solder bridges to supply power to some pins for use by remote gauges.

Pins 7 and 8 should pass straight through both crossover and 'straight' RJ45 ethernet cables allowing almost any to be used to connect the Controller Interface Board to a Victron GX device (i.e. Cerbo or Ekrano).

Please refer to the Törkmar Victron GX Installation Guide for more details on the cabling and configuration of the Victron GX devices.

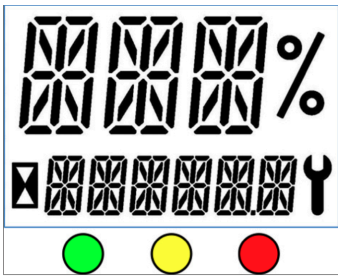
2.4 Commissioning

The Motor Controller will be delivered fully commissioned and ‘paired’ with the supplied motor. If it becomes necessary to recommission the motor controller, please contact Törkmar. To fully integrate with the cooling system and display, the controller will need to be configured with the parameters and a custom Curtis Instrument menu that supports these interfaces.

2.6 Curtis Instrument Display Installation

2.6.1 3141 Display

The 3141 supplied by Törkmar will be configured to operate in conjunction with the custom software running on the motor controller and will display the following:



Large Digits (top row)

- Normal Operation: Motor RPM
- Fault Operation: Letter ‘x’ then Fault Flash Code in hex – will cycle through all active faults

Small Digits (2nd row)

- Normal Operation: Total power consumption (motor/controller/pump) In Watts
- Fault Operation: This will show the text “Type” followed by the Fault Type in decimal (if the fault shown on the top row has a sub-type). The spanner symbol will also be shown. If the fault being shown has no fault type number then it will continue to show the power.

LEDs

- Green: Normal operation (below 30º)
- Yellow: The motor is warm, if operating at this speed for much longer consider switching on the cooling pump (default range for yellow is 30º to 60º)
- Red: The motor is hot, (>60º), the pump will have been automatically enabled

2.6.1.1 Software Compatibility

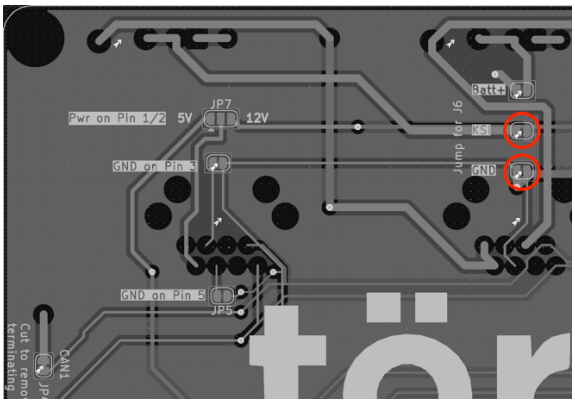
The Curtis 3141 gauge is supported on Törkmar controller software V3 onwards. It must be set to use 250kb/s and be on Node ID 0x71 (these settings will be applied by Törkmar prior to delivery).

2.6.1.2 CanBus Connection

A RJ 45 cable to 6-way TE ‘MATE-N-LOK’ connector will be supplied with the gauge. The RJ45 plug should be connected to the CAN 1A (J6) socket on the Controller Interface board. The following solder jumpers on the board must be bridged with solder to supply the gauge with power (if the interface board was ordered with the gauge, then these will have been pre-soldered).

Controller Interface Boards Rev C&D:

- JP3: Labelled KSI (in the “Jump for J6” group)
- JP1: Labelled GND (in the “Jump for J6” group)



2.6.1.3 Reading Faults

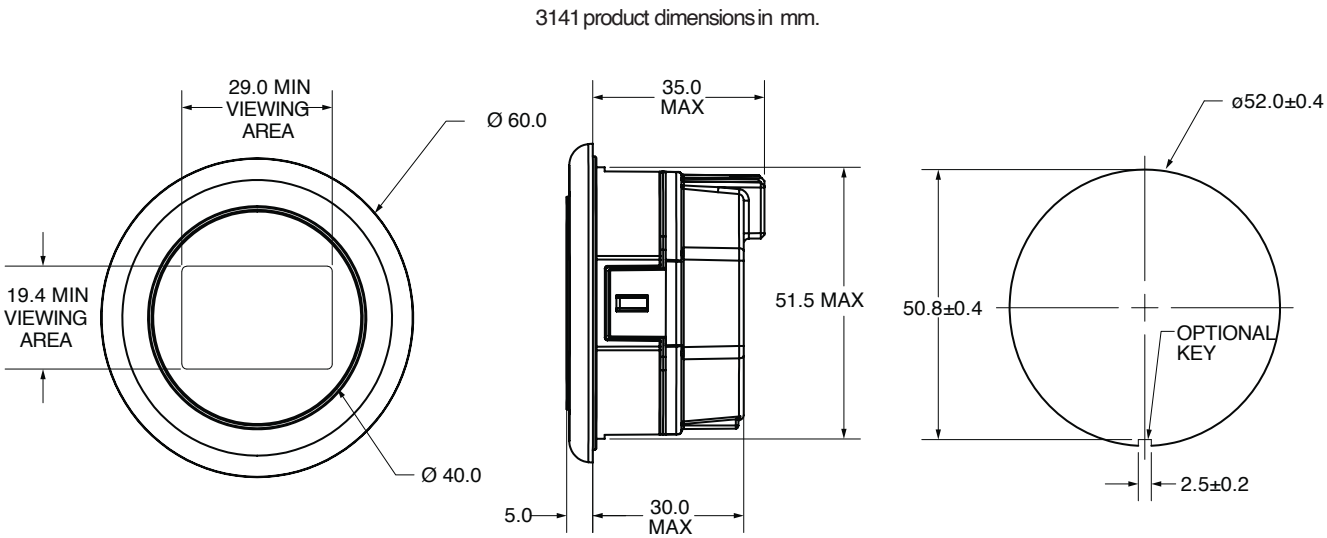
If the controller has one or more fault conditions, the spanner symbol will be shown, and the top row will cycle through the fault flash codes in hex ('x' followed by 2 digits). Note these down alongside any fault type shown on the 2nd row – the fault type will indicate a more precise reason for the problem. Most faults can be cleared by switching the key switch off then on to re-enable the motor.

Examples of faults are:

- Flash code: x35, Fault Type 1: Over-current on the motor
- Flash code: xA4, Fault Type 4: Over-current on the cooling pump

2.6.1.4 3141 Mounting Hole

If the gauge is not supplied mounted on the throttle plate, then a hole should be drilled according to the following dimensions:



3 Troubleshooting / support

3.1 Motor Controller Issues

In the absence of a Curtis programmer, the Motor Controller status can be obtained by checking the status indicator on the controller per the illustration above. The status indicator is a translucent window on the cover, which blinks red and yellow LEDs whose meanings are:

- Off: Controller is not powered on or is severely damaged.
- Slow yellow blinking: Controller is operating normally.
- Solid yellow or orange: Controller is in flash program mode, or corrupted software is preventing the unit from completing the startup sequence.
- Solid red: Internal hardware fault detected by the supervisor or primary microprocessor, or the controller has no software loaded.
- Red/yellow flashing pattern: Fault code, see below.

3.1.1 Motor Controller Fault Codes

The fault flash pattern is decimal.

For example, the “Main Contactor Did Not Close” is flash code 3-9. This would be indicated by 3 red LED flashes (x3) followed by 9 yellow LED flash (x9) before repeating.

Some common fault codes are:

3-9 (0x39): Main Contactor Did Not Close (check Contactor connections and operation)

3-10 (0x3A): Motor Setup Needed (contact Törkmar to re-commission the motor)

4-9 (0x49): Parameter Change (cycle the key switch to clear this fault)

For other fault codes, note the code and contact Törkmar support. If a 3141 gauge is installed and the controller is in a basic operable state, it will be easier to read the fault codes there – additionally it will show the type of fault (as a number).