Turntide Gen6 Low Voltage Inverters – (Extended) X

Gen6 Extended (Gen6-X) is an exceptional low voltage inverter, offering the highest power densities of ≈ **36 kW/L,** ≈ **33 kW/kg** boost, and ≈ **12 kW/L** (60 min), in its class on the market today. With additional I/O with respect to the standard version, robust isolation, and superior environmental durability, it's well-suited for demanding operating conditions of higher-power applications.



Capable of supporting both Permanent Magnet Synchronous Machines and AC Induction motors, Gen6-X is the first choice for low-voltage electrification requirements below 130V, delivering an extremely compact footprint.

Turntide User Code (TUC) is a feature-rich ANSI C based development environment designed for customised logical and algorithmic functions. It leverages an integrated auxiliary microprocessor and a comprehensive API to interface seamlessly with the primary motor controller.

A comprehensive library of validated motors is readily available for the inverter via an intuitive user interface, facilitating quick and straightforward vehicle setup.

Features

- > 95% Efficiency at peak current
- Accurate torque and speed control of IPM, SPM and IM
- Maximum torque per amp algorithms for interior permanent and surface magnets
- Licence locked motor speeds up to 20kRPM *(4pp ,machine and export licence)*
- Variable PWM frequency up to 12kHz
- Fan PWM control and speed tacho read back (or wheel speed sensor)
- Reliable operation in Field Weakening
- Physics-based vehicle control and setup
- Hill-hold, anti-jerk, active damping
- Wake on CAN capability
- Secondary CAN bus for baud rate bridging
- Optional finger guard for protection around the terminals to IPXXB

Applications

Suitable for electric traction and ancillaries control on mobile equipment applications; such as last-mile delivery, autonomous guided vehicles, other material handling equipment, airport ground support equipment, aerial platforms, construction machinery and performance 2 wheel applications.



Specification

Key Features					
Nominal Vdc	**Size 4 X - 48V**	**Size 6 X- 48V**	**Size 6 X- 80V**	**Size 6 X- 96V**	**Size 6 X- 110V**
Working Vdc Voltage Range (V)	20-63		20-106	20-118	20-130
DC Logic Supply (V)	6-16				
10s Boost Current (A_{rms})	600†	800†	700†	550†	480†
2min Peak Current (A_{rms})	450†	650†	550†	415†	360†
60min Current (A_{rms})	190†	250†	230†	200†	150†
10s Boost Motor Input Power (kW)	33†	43†	63†	60†	60†
2min Peak Motor Input Power (kW)	24†	35†	50†	45†	45†
60min Motor Input Power (kW)	10†	14†	20†	22†	19†
Max Fundamental Output Frequency	599Hz††				

†Assuming a PF of 0.95. and correctly mounted on a heatsink less than 0.3 C/W and 0.2 °C/W @ 25 °C ambient for Size 4 and Size 6 respectively.

††Higher frequencies available on request, contact Turntide for details.

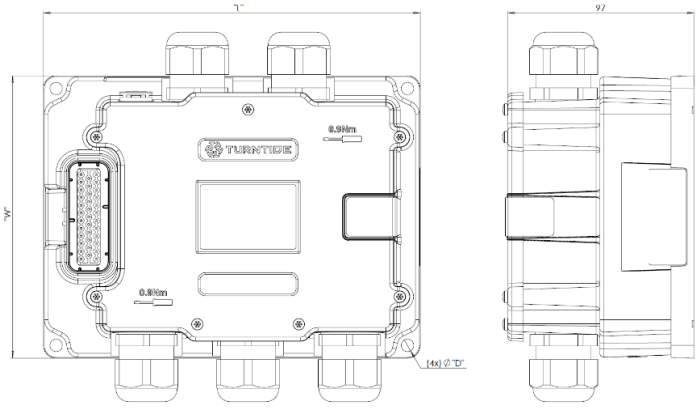
Control Features	• Remote Torque Actuator • Integrated Vehicle Control • Intelligent Torque Modulation • Line Contactor Control • User defined behaviours via TUC • Wake on CAN • Active Short Circuit • Programmable Fault Reactions • Customisable Data Feedback to CAN	**Comms Protocols**	• CAN 2.0A + CAN2.0B + FD in TUC • User Definable Messages • Custom Protocols via TUC • UDS (ISO 14229) • J1939 – proCAN • J1939 – H-Protocol

Environmental			
Inverter Cutback (Low) (˚C)	-40 to -20	**Inverter Cutback (High) (˚C)**	70 to 100
Ambient Operation (˚C)	-30 to 85	**IP Rating***	IP6KX, IPX6 & IPX7. IPXXB finger guard options available

** Ingress rating for non-operational protection see below for IP67 operational version*

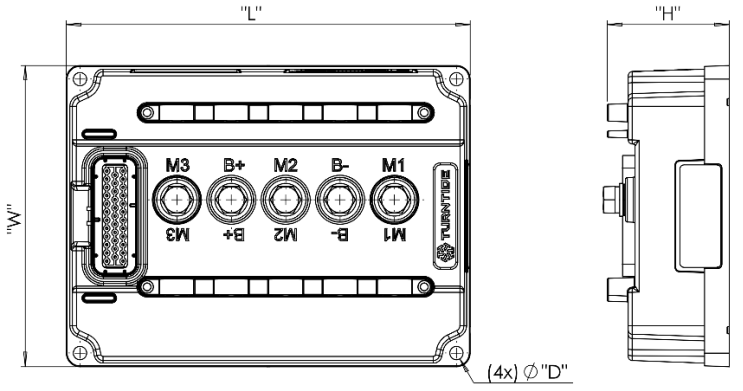
Mass, Dimensions and Drawings		
	Size 4	**Size 6**
Mass (g)	1590 / 1670 / 1825	1890 / 1970 / 2125
Length, L (mm)	197	197
Width, W (mm)	123	147
Height, H (mm)	59.5 / 73 / 97	
Mounting hole Ø, D (mm)	6.5	
Power Terminal Fixings	5 x M8	
Control Interface Header	TE AMPSEAL - 776164-1	

Values are mass and dimensions without / with optional finger guard / IP67 operational version



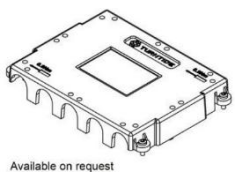
IP67 Operational Enclosure

The extended IP67 enclosure provides IPX6 & IPX7 additional protection for the power terminals allowing full power operation up to 1m submerged water wading. For cable sizes with an OD of 11mm-17mm.



IP67 non-operational + IPXXB Finger Guard

For a more compact and easy assembly, use the IP67 non-op. enclosure for more sheltered mounting positions where immersion is unlikely. IPXXB cover is available for finger-touch prevention.

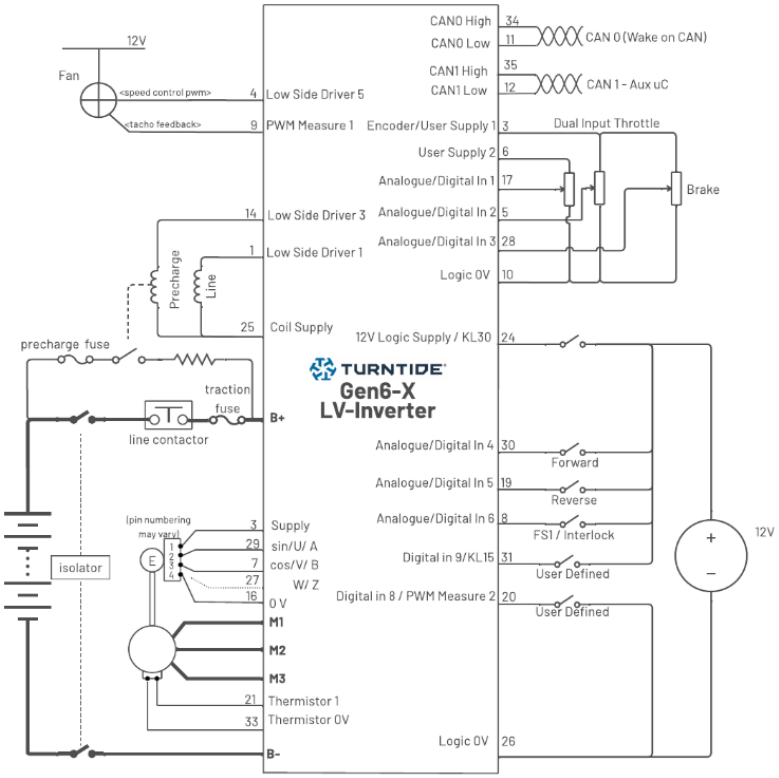


Available on request

Inputs and Outputs

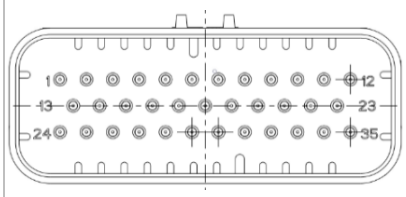
I/O	11x Configurable Inputs, each software-selectable, comprising: • up to **6x** Analogue or Digital† • up to **11x** Digital (active-low)†† • up to **2x** PWM-measure or Digital†† • up to **2x** doubling as Resolver excitation†† • **2x** 2 Amp Low Side Driver • **4x** 250mA Low Side Driver • **2x** PT100/PT1000/NTC5k/NTC10K	**Encoders**	One of the Following: • **1x** Absolute Position SinCos • **1x** Hall Effect UVW • **1x** Absolute Position ABZ+PWM • **1x** Resolver/Differential SinCos††† • **1x** Incremental AB
		Supply	• **2x** Selectable 5V Or 10V / 200mA

† - Selectable High or low Dig In, †† - Active Low Dig In; ††† - Available in alternative part number;



Application Example

††† - Available in alternative part number;
Pre-charge relay coil >= 50R



PIN	Description	PIN	Description	PIN	Description
1	Low Side Driver 1 [2A]	13	Low Side Driver 2 [2A]	24	KL30
2	Low Side Driver 4 [250mA]	14	Low Side Driver 3 [250mA]	25	Coil Supply
3	Encoder/User Supply 1	15	Low Side Driver 6 [250mA]	26	Logic 0V
4	Low Side Driver 5 [250mA]	16	Logic 0V	27	Encoder Z/W Resolver / Diff Sin -ve†††
5	Analogue 2 Digital In 2	17	Analogue In 1 Digital In 1	28	Analogue In 3 Digital In 3
6	User Supply 2	18	Resolver / Diff Cos -ve†††	29	Encoder A/U/Sin Resolver / Diff Sin +ve†††
7	Encoder B/V/Cos Resolver / Diff Cos +ve†††	19	Analogue In 5 Digital In 5	30	Analogue In4 Digital In 4
8	Analogue In 6 Digital In 6	20	Digital in 8 PWM Measure 2	31	Digital in 9 / KL15
9	Digital in 7 PWM Measure 1	21	Motor Thermistor 1	32	Motor Thermistor 2
10	Logic 0V	22	Digital In 10 Resolver Exc +ve†††	33	Logic 0V
11	CAN Low 1	23	Digital In 11 Resolver Exc -ve†††	34	CAN High 1
12	CAN Low 2			35	CAN High 2

Safety and Compliance

Electrical Safety*	• EN 60664-1 :2020 • ISO 6469-3 :2021 • AIS-156 (08/2022) + Amd. 3 (09/2022) • AIS-038 (12/2017) + Amd. 3 (09/2022)	**EMC***	• AIS-004 (07/2009) + Amd. 2 (09/2022) • Reg10:R6 • EN 61000-4-8:2010
Electrical Isolation	• 1.4kVdc to heatsink	**Functional Safety**	• Quality Managed
Product Safety	• CE Marked		

** Designed to meet the requirements of*

Additional Information

Turntide User Code

- A dedicated powerful 80Mhz 16bit (32kB RAM, 128kB Flash) micro for C-based development of custom features.
- Powerful API to interface to motor controller.
- Interfacing to third-party systems such as BMS and displays and HMIs becomes a trivial coding task via TUC.
- FreeRTOS based environment.
- Ownership and development of TUC under OEM control and development cycle
- Extensive examples provided.

General

- High reliability
- Designed for transport electrification through decades of proven experience
- Superior power density
- Optional finger guard for IPXXB compliance and general protection.
- An intelligent torque modulator is included which uses physics-based modelling to control the DC link voltages and currents, maximum motor speed, torque, and motor temperatures, based on CAN messages, TUC or programmable parameters.

Configuration

Turntide offers a Windows-based PC tool for configuration of the inverter. The tool provides a simple yet powerful means of accessing the inverter for diagnostics or parameter adjustment. Communication is through CAN. IXXAT, Peak and Vector CAN adaptors are supported, with support for others on request. Key features include:

- Library of validated motor configs
- Customisable login levels
- Powerful guided vehicle setup process
- Intuitive diagnostic processes

Ordering

When discussing parts with Turntide be sure to reference the features accordingly

Gen6 Size □ □ □ □□V □□□A

450,650,550, 415,360	Current is dictated by power frame rating, heat-sinking, ambient temperature, DC voltage and is not selectable
48,80,96,110	Voltage rating – 48V/80V/96V/110V
D	Position encoder: **Differential Sin Cos only**
L	50/50 WEG cooled integrated baseplate
R	**Resolver support only:** Pin 22, pin 23 **not** available as DIN
W	Sea water cooled integrated baseplate
P	IP67 operational enclosure.
X	Isolated 12V KL30/KL15 architecture Position encoder: Sin Cos, ABZ+PWM, AB, UVW – support Thermistor: PT100, PT1000, NTC (90-250k Ohm), Custom
4, 6	Two frame sizes available Size 4 and Size 6

Optional variants

Example:

Gen6 – Size 6	X	96V 415A - (Base Extended model)
Gen6 – Size 6	XR	80V 550A - (Extended model with Resolver)
Gen6 – Size 4	XDL	48V 450A - (Extended model with cooled baseplate and Differential Sin/Cos)

Note: Not all combinations are immediately available; please contact Turntide to discuss your needs. E.g. Size 4 – X is only available in 48V.

To find out more about this product, download the manual from our website. For details of Turntide's other inverters, motors, batteries, pumps and fans, visit our website or contact our team of experts at electrificationsales@turntide.com.