## Description (I)

**Application**

TRAX electronic module is designed to drive and control CARRARO TLB2 transmission in mobile applications

**Main TRAX ECU features:**

- Remote mounting
- High I/O capability for advanced applications
- Advanced ARM7-TDMI microcontroller
- Coils currents digital closed loop control
- Active shuttle clutches management during up and down shifting
- Real time system diagnosis available via RS232 / CAN BUS
- High insulation degree
- Broad range of supply voltages without degradation in performance
- Reverse polarity protected power supply
- Short circuit proof coil outputs
Description (II)

**TRAX hardware features:**

- 4 analog inputs (also configurable as digital inputs)
- 1 analog input specific for temperature sensor
- 2 frequency inputs for hall-effect or inductive speed sensors
- 1 encoder input for double hall effect speed sensors
- 4 PWM outputs (2A, also configurable as digital output)
- 6 source digital outputs (2A)
- 2 sink digital outputs (2A)
- 12 digital inputs (configurable pull-up or pull-down)
- Serial Interface standard RS232 for diagnostics and service

Dimensions: c. 150 x 100 mm.
Enclosure: c. 190 x 120 mm, IP67.
Power Supply: 12V DC rated
Description (V)

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TRAX connector
# TLB2 + TRAX Features overview

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## Basic Package

- Forward – Reverse Management
- Manual gear selection
- Declutch Feature
- TRAX Status Signal available for Vehicle Dashboard
- RS232 Communication for service and diagnostics

## Optional Features

- Automatic gear-shifting
- Kick-down
- Signal exchange between TRAX and vehicle dashboard
- Signal exchange between TRAX and 4WS steering ECU
- 4WD Management
- HDL Management
- CAN bus communication
# TLB2 + TRAX Pin-Out (I)

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<table>
<thead>
<tr>
<th>TRAX PIN</th>
<th>TRAX PIN Description</th>
<th>Configuration</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Logic Supply +12V</td>
<td>+12v battery</td>
<td>Direct to battery</td>
</tr>
<tr>
<td>17,29</td>
<td>Logic ground Battery GND</td>
<td>Direct to battery</td>
<td></td>
</tr>
<tr>
<td>2,30,5,32,8,35,36,34</td>
<td>Power Supply +12V</td>
<td>+12v battery under key</td>
<td>Battery under key</td>
</tr>
<tr>
<td>18</td>
<td>Digital input 01</td>
<td>Pull-down</td>
<td>Forward input command</td>
</tr>
<tr>
<td>46</td>
<td>Digital input 02</td>
<td>Pull-down</td>
<td>Reverse input command</td>
</tr>
<tr>
<td>19</td>
<td>Digital input 03</td>
<td></td>
<td>GearCmd01 input command</td>
</tr>
<tr>
<td>47</td>
<td>Digital input 04</td>
<td></td>
<td>GearCmd02 input command</td>
</tr>
<tr>
<td>20</td>
<td>Digital input 05</td>
<td></td>
<td>Crab signal (optional)</td>
</tr>
<tr>
<td>48</td>
<td>Digital input 06</td>
<td>Pull-up</td>
<td>Circle signal (optional)</td>
</tr>
<tr>
<td>21</td>
<td>Digital input 07</td>
<td></td>
<td>Declutch input command</td>
</tr>
<tr>
<td>49</td>
<td>Digital input 08</td>
<td></td>
<td>Kickdown input command (optional)</td>
</tr>
<tr>
<td>22</td>
<td>Digital input 09</td>
<td>Pull-down</td>
<td>4WD Switch (optional)</td>
</tr>
<tr>
<td>50</td>
<td>Digital input 10</td>
<td></td>
<td>STOP Switch (optional)</td>
</tr>
<tr>
<td>43</td>
<td>Temperature input NTC</td>
<td></td>
<td>Temperature sensor</td>
</tr>
<tr>
<td>44</td>
<td>Analog Input 01</td>
<td>Pull-up</td>
<td>Main Ring Pressure Switch</td>
</tr>
<tr>
<td>25</td>
<td>Frequency Input 01 Inductive</td>
<td>Transmission output speed sensor</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Frequency Input 02 Inductive</td>
<td>Engine alternator “W” signal</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Rs232 TX</td>
<td></td>
<td>Serial/CAN interface</td>
</tr>
<tr>
<td>56</td>
<td>Rs232 RX</td>
<td></td>
<td>Serial/CAN interface</td>
</tr>
<tr>
<td>27</td>
<td>CAN: CAN_H</td>
<td></td>
<td>Serial/CAN interface</td>
</tr>
<tr>
<td>55</td>
<td>CAN: CAN_L</td>
<td></td>
<td>Serial/CAN interface</td>
</tr>
<tr>
<td>26</td>
<td>CAN: SHIELD</td>
<td></td>
<td>Serial/CAN interface</td>
</tr>
<tr>
<td>3</td>
<td>PWM 01 Output</td>
<td>PWM</td>
<td>Forward valve command</td>
</tr>
<tr>
<td>12</td>
<td>PWM 01 Current</td>
<td>Current input</td>
<td>Forward valve current feedback</td>
</tr>
<tr>
<td>7</td>
<td>PWM 04 Output</td>
<td>PWM</td>
<td>Reverse valve command</td>
</tr>
<tr>
<td>41</td>
<td>PWM 04 Current</td>
<td>Current input</td>
<td>Reverse valve current feedback</td>
</tr>
<tr>
<td>9</td>
<td>Digital output 01 Source digital out</td>
<td>Valve s1 (1st Gear)</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Digital output 02 Source digital out</td>
<td>Valve s2 (2nd Gear)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Digital output 03 Source digital out</td>
<td>Valve s3 (3rd Gear)</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Digital output 04 Source digital out</td>
<td>Valve s4 (4th Gear)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Digital output 05 Source digital out</td>
<td>HDL Valve (optional)</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Digital output 06 Source digital out</td>
<td>4WD Valve (optional)</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Digital output 07 Switch to ground digital out</td>
<td>dashboard “Automatic” Lamp (optional)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Digital output 08 Switch to ground digital out</td>
<td>Buzzer / danger lamp</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>PWM02 Output</td>
<td>as digital output, source</td>
<td>4WD Lamp</td>
</tr>
</tbody>
</table>
TRAX Pin-Out (II)

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TRAX PINOUT OVERVIEW

- Logic Supply
- Power Supply A
- PWM Output 1-2
- Power Supply B
- PWM Output 3-4
- Digital Outputs (src)
- Power Supply C
- PWM Feedback 1-4
- Digital Outputs (src)
- Power ground

- Sensor supply output
- Logic Ground
- Digital Inputs
- Serial Line RS232
- CAN
- Frequency Inputs
- Analogue Input
- Temperature Input
## Electrical Tests

<table>
<thead>
<tr>
<th>Test Principle</th>
<th>Severity level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating Voltage</strong></td>
<td>Test for impaired function while Usupply = 10.5 – 16 Vdc</td>
</tr>
<tr>
<td>ASAE EP455 § 5.10.1 Level 2</td>
<td></td>
</tr>
<tr>
<td><strong>Over Voltage</strong></td>
<td>Test for impaired function after 5 min at Usupply = 26 Vdc</td>
</tr>
<tr>
<td>ASAE EP455 § 5.10.2 Level 2</td>
<td></td>
</tr>
<tr>
<td><strong>Batteryless Operation</strong></td>
<td>Test for impaired function after Usupply = 6 + 12.6(sin (2πf)) Source impedance = 1.5 Ω F = 500 Hz – 1.5 kHz over 5 min</td>
</tr>
<tr>
<td>ASAE EP455 § 5.11.3 Level 2</td>
<td></td>
</tr>
<tr>
<td><strong>Reverse Polarity</strong></td>
<td>Test for impaired function after 5 min at Usupply = -26 Vdc</td>
</tr>
<tr>
<td>ASAE EP455 § 5.10.3</td>
<td></td>
</tr>
<tr>
<td><strong>Short Circuit to Ground Protection</strong></td>
<td>Test for impaired function after shorting for 5 min all external leads to ground at Usupply = 16Vdc</td>
</tr>
<tr>
<td>ASAE EP455 § 5.10.4</td>
<td></td>
</tr>
</tbody>
</table>
Installation notes (I)

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Installation block diagram
Valeo selector drawing

For reference only
Customer is open to choose another selector if electrically compatible. Please contact Carraro for further information.
**Installation notes (III)**

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**Valeo selector connector**

- CONNECTOR V1 -
- Receptacle: DEUTSCH DT 04-8PA-CE02

Mates with:
- Plug: DEUTSCH DT 06-8S

For reference only
Customer is open to choose another selector if electrically compatible. Please contact Carraro for further information.
Installation notes (IV)

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TLB2 transmission hydraulic connectors with HDL valve

- CONNECTORS: 1st, 2nd, 3rd, 4th, FWD, RVS, 4WD, HDL
Receptacle: DEUTSCH DT 04-2P

Mates with:
Plug: DEUTSCH DT 06-2S
Installation notes (V)

TLB2 transmission hydraulic connectors **without HDL valve**

- CONNECTORS: 1st, 2nd, 3rd, 4th, FWD, RVS, 4WD
  Receptacle: DEUTSCH DT 04-2P

Mates with:
*Plug: DEUTSCH DT 06-2S*
TRAX Serial/ CAN interface

- TRAX ECU can communicate with other peripherals via RS232 serial line / CAN
- Suggested serial/can connectors:
  - Deutsch DTM06-06S-E007 (TRAX ECU side)
  - Deutsch DTM04-06P-E003 (CAN BUS / SERIAL interface)
- Serial line PC connection (optional diagnostic interface):
  - DB9 SUB-D (male housing, female pins) connectors (see next page wiring spreadsheet)
Basic package (I)

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Forward - Reverse Management

- Neutral position selected: Vehicle stopping or rolling free
- Forward position selected: Vehicle moving in forward direction
- Reverse position selected: Vehicle moving in reverse direction
- All 4 gears allowed in Forward and Reverse
Basic package (II)

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Manual gear selection

Shifter selector positions: 1-2-3-4

- Position 1: 1st gear engaged
- Position 2: 2nd gear engaged
- Position 3: 3rd gear engaged
- Position 4: 4th gear engaged

Selected gear not engaged until vehicle speed is not compatible
Basic package (III)

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Declutch feature

Instantaneous interruption in power transmission, irrespective of shifter position (FWD, RVS), piloted by the driver through a monostable switch.

TRAX status signal available for Vehicle Dashboard

TRAX is capable to provide a single electric signal to allow a visualization of its current operating status. Typical application: failure blinking codes, indication of incongruence between selected and engaged gear, etc.

RS232/ CAN Communication

Via RS232 serial port or CAN port, TRAX allows typical functions related to the communication as real time visualization of system variables, system parameterisation, advanced diagnostic, history error log.
Optional features (I)

Automatic gear shifting

- **Shifter selector positions:**
  - Position 1: 1st gear engaged
  - Position 2: 2nd gear engaged
  - Position 3: 3rd gear engaged
  - Position 4: 2nd to 4th automatic gear shifting depending on vehicle speed
  - 2nd gear engaged in automatic mode when starting (if speed is compatible)
  - AUTO to Manual mode switching always available

**Important:**
While above described principle is actually considered the state-of-the-art for automatic gear shifting, Carraro is available to develop different feasible logic in case of customer special requests
Optional features (II)

KICK-DOWN

Principle of functioning
- Sequential Up & Down shifting (i.e., 2nd to 1st, then 1st to 2nd, ...)
- Kick Down can be armed only when 2nd gear is engaged
- Kick Down function is always available, irrespective of shifter position (F, N, R)
- Kick Down is cancelled shifting the gear selector (1st, 2nd, 3rd, Auto)
- Kick Down is maintained moving the shifter position (F to N, F to R, ...)

During manual gear selection
- After Kick Down selection, 1st gear is maintained irrespective of vehicle speed

During automatic gear shifting
- Kick Down is cancelled exceeding a programmable speed threshold

Important:
While above described principle is actually considered the state-of-the-art for kick-down, Carraro is available to develop different feasible logic in case of customer special requests.
Optional features (IV)

4WD management

4WD feature works in negative way, that is if the 4WD operator switch is OFF (4WD disabled), then 4WD valve is ON. 4WD operator switch can activate 4WD feature in all operating conditions (1st, 2nd, 3rd or 4th gear), while it is automatically activated if the transmission is in 3rd or 4th gear and the operator brakes.

HDL management

if 1st or 2nd gear is engaged, then HDL switch is enabled to pilot HDL valve, which is responsible to activate the differential lock feature

Important:

Carraro is available to assist the customer during vehicle wiring design in order to electrically implement the above mentioned features