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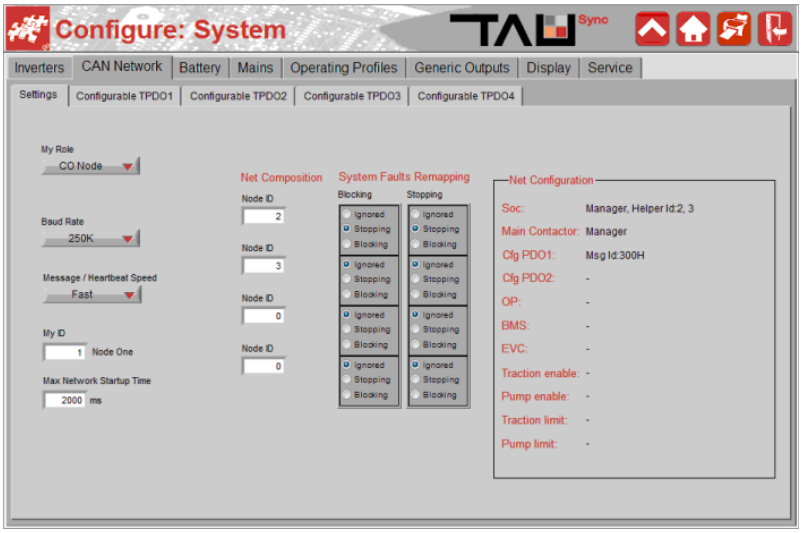
CONTROLLER AREA NETWORK (CANBUS) CONFIGURATION

ConfigurableTPDO

AC-L1 [Traction]:

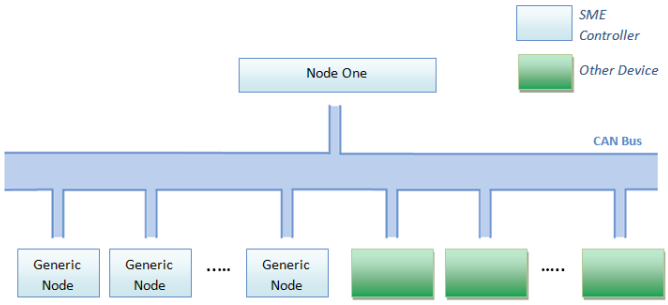
- **Node ID:** 1
- **Main Contactor Role:** Manager
- **Battery SOC Role:** Manager
- **Configurable TPDO1:** Enabled
- **Configurable TPDO2:** Enabled

In order to configure the previous features, you must enable the CAN Network.



The basic choice is the parameter **My Role:**

- **Standalone:** The controller is configured as standalone without a network.
- **CO Node:** CAN Open Node. In this case you create a network composed by some nodes. There are two type of CO Nodes:
  - **Node One:** You must specify Node One, the Net Manager. You must complete the Net Composition with the Node One ID and listing all active Generic Nodes in the network with their ID. This node can cause the falling down of the network in case of fault.
  - **Generic Node:** one of the secondary nodes in your network.



In order to let TAU Controllers work together, you must insert every other TAU node of your Network in the Net Composition List in order to check its presence. Be careful, only Controllers' IDs must be set here (no need to set the IDs of external devices).

Each Net Node can ignore or remap the level of the worst blocking or/and stopping fault of the Nodes specified. This can be done using the field **"System Faults Remapping".**

All Controllers in the network must send their presence and see each others before the **Max Network Startup Time** in order to synchronize the CAN Network. Otherwise a synchro failed fault will be signaled.

WARNING: Before starting the system, check that all Nodes are properly connected to CANOpen network to avoid wrong net starting sequence or faults. The Baud Rate of all Nodes in the network must be the same.

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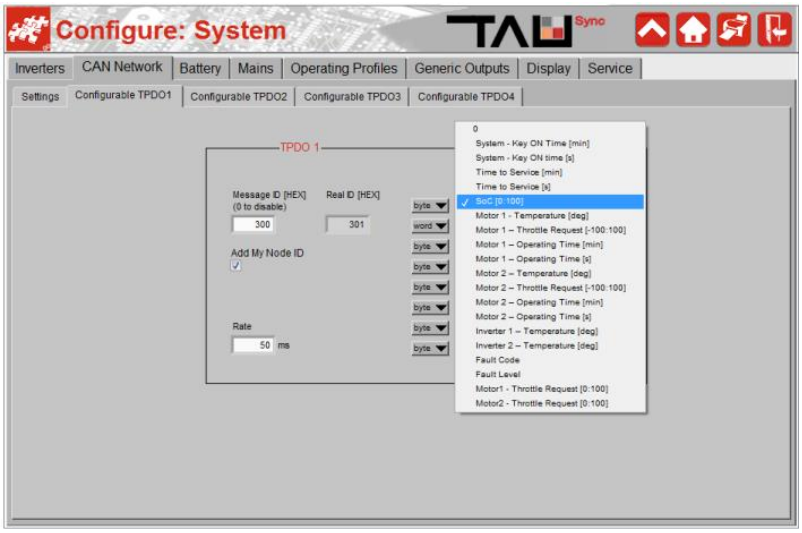
CONFIGURABLE TPDO

After enabling the CAN Network, you can customize four sets of 8-bytes totally configurable PDO, called configurable TPDO, which can be used in a network to send data to third party components like display or PC. The Baud Rate of the network is the same set in Network Configuration



You can freely compose each configurable TPDO simply setting three fields:

- **ID:** It's the message Identifier Code, in your network you will see this value added to the Node ID if you enable the flag under it. It must be an HEX value, different from:
  - **0x080**
  - **0x100**
  - **0x180**
  - **0x280**
  - **0x0380**
  - **from 0x0580 to 0x67F**
  - **0x700**

- **from 0x77F to higher values**

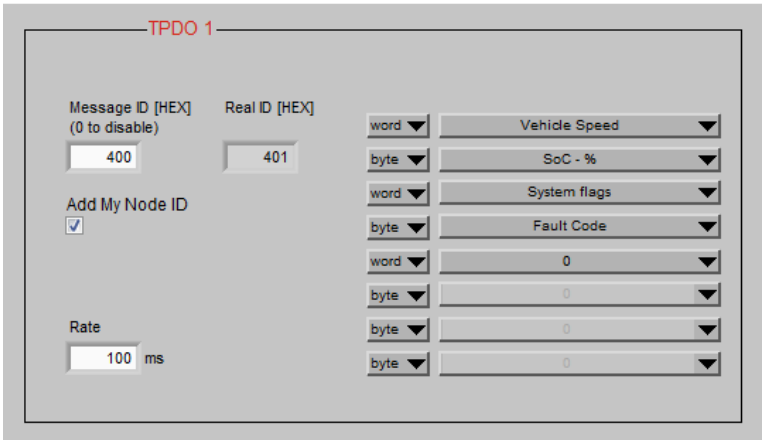
If the value is set to 0, the TPDO is disabled.

- **Rate:** It's the message Rate. It is expressed in ms and the minimum permitted value is 20ms.
- **Message:** The message is composed by 8 bytes. There's a list of available variables classified by size, word or byte, where you can choose the data that you want to send.

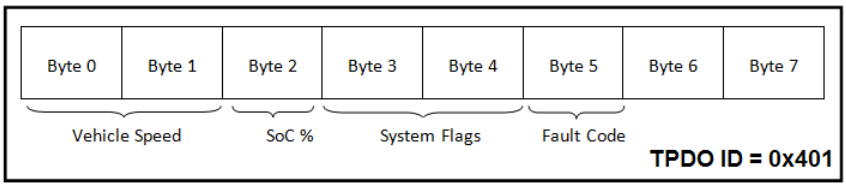
In the following example, you can see a real system configuration. In an electrical vehicle you usually need to see:

- The Speed of the vehicle.
- The Battery State of Charge.
- The State of Brakes (available in System Flags).
- The Fault Code.

If you want to use an external display and see some information about your system, you have to set your TPDO like:



In order to visualize the data sent, you must configure your display to receive messages with the ID and the rate set on "Message ID" and "Rate" tabs, structured as:



WORD FORMAT: All words are sent in Little-endian format which reverses the order and stores the least significant byte at the lower memory address with the most significant byte being stored at the highest memory address.

TPDO STRUCTURE

TAU CAN Network provides four types of Data:

1. **Empty Data Type:**

NAME	SIZE	UNIT	REMARKS	RANGE
Empty Byte	Byte	-	Empty byte introduced in the message	-
Empty Word	Word	-	Empty word introduced in the message	-

2. **Node Data Type:**

NAME	SIZE	UNIT	REMARKS	RANGE
Key Switch Voltage	Word	cV	Controller Supply Voltage	[-32768; +32767] ↔ [-327.68; +327.67]V
DC Bus Voltage	Word	dV	Internal Capacitors Voltage	[-32768; +32767] ↔ [-3276.8; +3276.7]V
My Node DC Bus Current	Word	dA	Node DC Bus Current, estimated or sniffed from BMS (depending on configuration)	[-32768; +32767] ↔ [-3276.8; +3276.7]A
My Node DC Bus Current Abs	Word	dA	Abs of the Node DC Bus Current, estimated or sniffed from BMS (depending on configuration)	[0; +65535] ↔ [0; +6553.5]A
Vehicle Speed	Word	km/hx10	Vehicle Speed calculated based on the gear and wheel diameter set by user	[-32768; +32767] ↔ [-3276.8; +3276.7]km/h
Vehicle Speed Abs	Word	km/hx10	Vehicle Speed calculated based on the gear and wheel diameter set by user	[0; +65535] ↔ [0; +6553.5]km/h
Vehicle Speed	Word	km/hx16	Vehicle Speed calculated based on the gear and wheel diameter set by user	[-32768; +32767] ↔ [-2048; +2048]km/h
Vehicle Speed Abs	Word	km/hx16	Vehicle Speed calculated based on the gear and wheel diameter set by user	[0; +65535] ↔ [0; 4096]km/h
Vehicle Speed	Word	mphx10	Vehicle Speed calculated based on the gear and wheel diameter set by user	[-32768; +32767] ↔ [-3276.8; +3276.7]mph
Vehicle Speed Abs	Word	mphx10	Vehicle Speed calculated based on the gear and wheel diameter set by user	[0; +65535] ↔ [0; +6553.5]mph
Vehicle Speed	Word	mphx16	Vehicle Speed calculated based on the gear and wheel diameter set by user	[-32768; +32767] ↔ [-2048; +2048]mph
Vehicle Speed Abs	Word	mphx16	Vehicle Speed calculated based on the gear and wheel diameter set by user	[0; +65535] ↔ [0; 4096]mph
Battery SoC	Byte	%	State of Charge	[0; +100] ↔ [0; +100]%
Fault Code	Byte	-	Worst Faul Code active in the controller	[0; +150] ↔ [0; +150]
Fault Level	Byte	-	Worst Faul Level active in the controller	• 0 = Ready • +1 = Blocking • +2 = Stopping • +3 = Limiting • +4 = Warning
System Flags	Word	Bitmask	BIT0 SoC is Low For Traction BIT1 SoC is Low For Hydraulic BIT2 Reverse Direction Active BIT3 Forward Direction Active BIT4 Park Brake Active BIT5 Pedal Brake Active BIT6 Controller is in Overtemperature BIT7 Key Switch Overvoltage BIT8 Key Switch Undervoltage BIT9 Vehicle is Running BIT10 Traction is Enabled BIT11 Hydraulic is Enabled BIT12 Powering is Enabled BIT13 Powering is Ready BIT14 Powering is Precharging BIT15 Main Contactor Closing	0 = FALSE; 1 = TRUE
System Odometer - HIGH	Word	Dam	Most significant word of System odometer value	-
System Odometer - LOW	Word	Dam	Less significant word of System odometer value	-
System Key On Time	Word	Hour	System lifetime hours	[0; +65535] ↔ [0; +65535]Hour
System Key On Time	Byte	Minute	System lifetime minutes	[0; +255] ↔ [0; +255]Minute
System Key On Time	Byte	Second	System lifetime seconds	[0; +255] ↔ [0; +255]Second
Time To Service	Word	Hour	Remaining hours to maintenance/assistance	[0; +65535] ↔ [0; +65535]Hour
Time To Service	Byte	Minute	Remaining minutes to maintenance/assistance	[0; +255] ↔ [0; +255]Minute
Time To Service	Byte	Second	Remaining seconds to maintenance/assistance	[0; +255] ↔ [0; +255]Second

3. **Inverter/s Information Data Type:**

NAME	SIZE	UNIT	REMARKS	RANGE
Inverter 1 - Temperature	Byte	°C	Inverter 1 temperature, with an offset of 40°C	[0; +255] ↔ [-40; +215]°C
Inverter 2 - Temperature	Byte	°C	Inverter 2 temperature, with an offset of 40°C	[0; +255] ↔ [-40; +215]°C

4. **Motor/s Information Data Type:**

NAME	SIZE	UNIT	REMARKS	RANGE
Motors Flags	Word	Bitmask	BIT0 Active Limitation of Motor1 BIT1 ChannelA of Motor1 Encoder BIT2 ChannelB of Motor1 Encoder BIT3 Motor1 in Overtemperature BIT4 Active Limitation of Motor2 BIT5 ChannelA of Motor2 Encoder BIT6 ChannelB of Motor2 Encoder BIT7 Motor2 in Overtemperature BIT8÷BIT15 Reserved	0 = FALSE; 1 = TRUE
Motor 1 - Temperature	Byte	°C	Motor 1 Temperature (offset of 40°C)	[0; +255] ↔ [-40; +215]°C
Motor 1 - Throttle Request	Byte	%	Motor 1 Throttle Request	[-128; +127] ↔ [-100; +100]%
Motor 1 - Throttle Request Abs	Byte	%	Motor 1 Throttle Request Abs	[0; +255] ↔ [0; +100]%
Motor 1 - Current	Word	dArms	Motor 1 Phase Current	[-32768; +32767] ↔ [-3276.8; +3276.7]Arms
Motor 1 - Iq Reference	Word	dArms	Motor 1 Iq Reference Current	[-32768; +32767] ↔ [-3276.8; +3276.7]Arms
Motor 1 - Iq Reference Abs	Word	dArms	Motor 1 Iq Abs Reference Current	[0; +65535] ↔ [0; +6553.5]Arms
Motor 1 - Torque	Word	%	Motor 1 Torque	[-32768; +32767] ↔ [-100; +100]%
Motor 1 - Torque Abs	Word	%	Motor 1 Torque Abs	[0; +65535] ↔ [0; +100]%
Motor 1 - Speed Reference	Word	rpm	Motor 1 Speed Reference	[-32768; +32767] ↔ [-32768; +32767]rpm
Motor 1 - Speed Reference Abs	Word	rpm	Motor 1 Speed Reference Abs	[0; +65535] ↔ [0; +65535]rpm
Motor 1 - Speed	Word	rpm	Motor 1 Speed	[-32768; +32767] ↔ [-32768; +32767]rpm
Motor 1 - Speed Abs	Word	rpm	Motor 1 Speed Abs	[0; +65535] ↔ [0; +65535]rpm
Motor 1 - Operating Time	Word	Hour	Motor 1 Operating Time Hours	[0; +65535] ↔ [0; +65535]Hour
Motor 1 - Operating Time	Byte	Minute	Motor 1 Operating Time Minutes	[0; +255] ↔ [0; +255]Minute
Motor 1 - Operating Time	Byte	Second	Motor 1 Operating Time Seconds	[0; +255] ↔ [0; +255]Second